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THE MODEL ENGINEER

The MODEL ENGINEER

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SMOKE RINGS

Bigger and Brighter!

● AS MOST of our readers are aware, due to the limitation of paper supplies, it has been made necessary for some years to produce THE MODEL ENGINEER in its present small size. However, we have endeavoured to maintain both the quality and the quantity of its contents, and the very considerable increase in circulation which has taken place during this period indicates that our efforts in this direction have not been in vain. Nevertheless, the prospect of restoring THE MODEL ENGINEER to its pre-war size has always been kept in view and, now that the paper situation has improved, we are pleased to announce that we are able to put this into effect.

As from the commencement of the new volume on January 1st next, the size of THE MODEL ENGINEER pages will be enlarged to make it uniform in size with its companion P.M. publications, *The Model Railway News*, *Model Aircraft* and *Model Ships and Power Boats*. A new and attractive cover in two colours has been designed and certain changes will be made in the presentation of the contents. These will not only enable us to improve the layout, but also to increase the amount of reading matter in each issue. We would, however, like to emphasise that in all other respects THE MODEL ENGINEER will remain the same helpful, friendly magazine that it has always been.

These changes are being made at a time when the circulation of THE MODEL ENGINEER is at its zenith, and, despite the necessarily increased production costs involved, we are pleased to say that there will be *no increase in the price.*

Naturally, we are pleased to be able to put into effect our plans for expanding THE MODEL ENGINEER which, due to circumstances beyond our control, have had to be deferred for some time. We are confident that our readers will agree with us that the progressive changes which we shall be making as from January 1st will result in a very much improved "M.E."

Our Cover Picture

● THE PHOTOGRAPH this week was taken last summer at the Hove Lagoon during the Prototype Sailing Models Regatta. This regatta, which was organised by the Thames Shiplovers and Ship Modellers Society, in conjunction with the Hove Model Yacht Club, was first held in 1951. It has proved very popular and promises to become an annual event. The idea was suggested as a break-away from the usual model yacht club meeting, which invariably consists of races between model yachts specially designed for speed. It makes a special appeal to those who love ships and sailing vessels of all types from the tiniest smack or lugger to the magnificent

full-rigger. It also provides the spectacle of the large square-rigger under full sail, generally recognised as one of the finest sights ever beheld by man, although admittedly here it is on a much smaller scale. The dainty little topsail schooners with two or three masts were once a common sight from our shores, and when these were seen along with the smaller fishing craft, and possibly a spritsail barge or two, with perhaps a big square-rigger in the offing, the whole made a picture full of interest and charm. These days were recalled to many, especially to the older spectators, at the Hove regatta. There seemed to be all types of sailing craft, from the two large four-mast barques, a few full-rigged ships and topsail schooners, fore-and-aft schooners, ketches, yawls, a Colchester smack, four spritsail barges, a Chinese junk, a catamaran, and even an Elizabethan galleon. It was a wonderful tribute to the fascination of sail, the interest to be obtained from building such models, and the joy of sailing them as apart from racing. Our picture shows one of the fore-and-aft schooners being set on her course. The interesting deck fittings will be noted and the little dinghy stowed on the hatch.

Sussex Miniature Locomotive Society

● WE ARE glad to learn that the first public general meeting called to consider the planning and management of the fine locomotive running track at Beech Hurst, Haywards Heath, Sussex, was well attended. Among those present, the Cuckfield Urban District Council was represented by Mr. L. Whittington, M.B.E., chairman of the Beech Hurst Committee, and Mr. R. J. Willett, surveyor; Mr. E. A. H. Brown, chairman of the Mid-Sussex Model Engineering Society, presided, and there were representatives from several other model engineering societies.

Mr. J. I. Austen-Walton was elected to the important post of track manager; he will be assisted by a committee, to which Messrs. C. Hudson, jr., A. L. Clarke, A. Funnel, S. R. Bostel, R. C. Rawling and L. Whittington were elected. The lease of the track site has been successfully negotiated, signed and becomes operative on January 1st, 1953. The committee will appreciate every assistance from any interested club or society in the construction of the track but the meeting agreed to put out to contract the heavier work of building the many brick piers required, and to endeavour to get this done as soon as possible.

Mr. Whittington announced that the bricks acquired from Lt.-Cdr. Ronald Hardy, at a reduced price, were on the site, and he would be pleased to present them to the society. This announcement was greeted with applause. Mr. Whittington pointed out that the Council would be wanting some return for money spent in laying out the site, and hoped that, in attracting many people, the railway would help to make Beech Hurst self-supporting. He suggested that all members did their best to get donations to the fund to complete the track, and he hoped that the railway, the tennis courts and the bowling greens could be opened in Coronation Week and make a big show.

Mr. Austen-Walton expressed his desire to establish a system of signalling and other embellishments which would put the railway beyond just being a track, and Mr. Rawling mentioned that the Mid-Sussex Club had already given some consideration to signalling arrangements which would serve as a basis for discussions by the new committee.

The chairman expressed his thanks for the support already received, and Mr. Whittington added that such a project merited the interest and support of clubs in all parts of the country. We endorse these sentiments and we hope that the whole scheme will meet with every success and ensure that Beech Hurst will become a favourite resort for all who own and run, or are in any way interested in the operation of miniature steam locomotives. Incidentally, the track is being built to accommodate locomotives of 3½-in. and 5-in. gauges.

The Model "Racing Four"

● MR. H. G. B. GRIFFITH, of Abergavenny, has sent us an interesting letter anent our comments under "Rowing in the Tank," November 20th issue; he writes: "You suggested that a race between two boats would add to the entertainment. I quite agree, and the racing element was the only cause which induced my friend and I to build such boats. Our race took place on the school baths at Monmouth, and as the school and the town are rowing centres, it caused quite a surprising amount of interest. We feel that organised regattas for eight- or four-oared and sculling boats might very well introduce quite a new sport.

"My main idea in exhibiting my boat was to try to interest other model makers to attempt this new and very interesting adventure. As far as I know, our two boats are the only ones in existence, so there is a clear field for all sorts of experiments, and it would be extremely interesting to see what lines racing boats would develop in face of keen competition.

"If any of your readers would like to have a go, I should be pleased to help them make a start, although I have no complete sets of plans. Neither my friend nor I are skilled model makers, only possessing hand drills for any turning required, so no one need be afraid of the actual construction. Thinking out a suitable mechanism to work the oars properly, however, is quite another story and full of fascinating problems. If anyone would like to make a boat like ours, the following conditions would have to be fulfilled in order to have reasonable class standard: Length overall, 48 in.; maximum beam, 3 in.; depth, 1 in.; length of oars to centre of boat, 12 in.; height of oarsmen, 6 in.; the action of the oarsmen should be reasonably lifelike and the action of the oars *must* be correct as regards the feathering and dipping in and out of the blades."

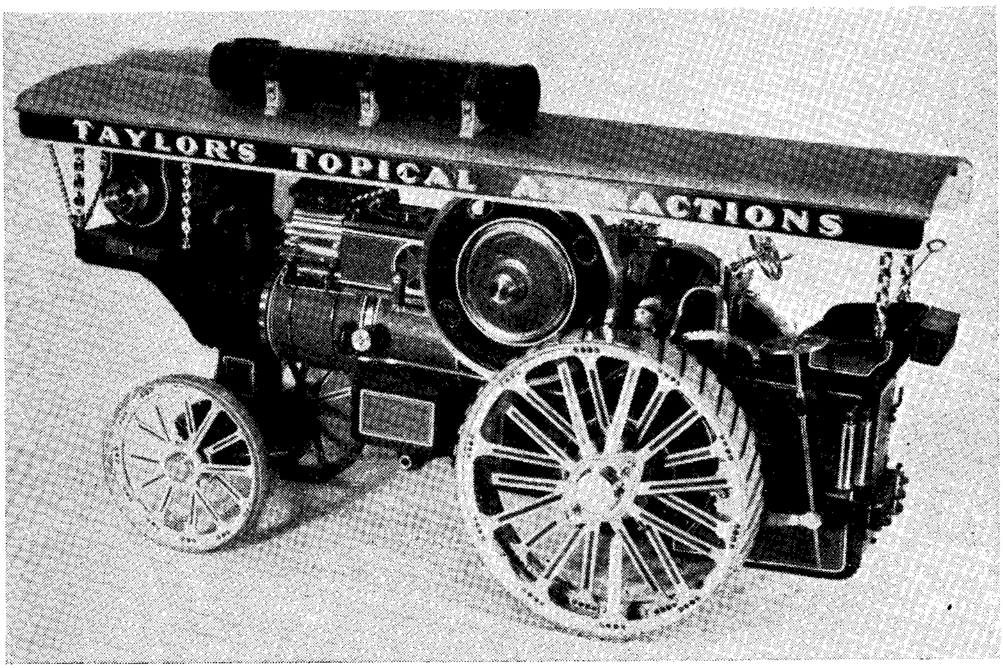
This seems to us to be a sporting offer, and we hope that some readers will take advantage of it; we are certain that races between such boats would cause amusement and excitement, wherever held. Naturally, we hope that the MODEL ENGINEER Exhibition next year may be the first occasion for such races.

TRACTION ENGINES

at "The Model Engineer" Exhibition

by W. J. Hughes

IT was a matter of great pleasure to many visitors to this year's exhibition to see that the traction engine was better represented than for many years. Moreover, not only was the general standard of work in this section higher, but there were several really outstanding models of very interesting prototypes. In fact, out of eleven models in the competition section, no less than eight won awards, including two silver medals and a bronze.



This beautifully-finished Fowler road locomotive was awarded a silver medal

A Fowler Showman's Engine

One of the silver medal winners was G. C. Taylor, with his A5 Fowler road locomotive, and it was easy to believe the builder's statement that this occupied ten years of his spare time! As a first model, it was all the more creditable; the detail work and the finish were superb.

The cylinder-block was the only casting, and Mr. Taylor had made special patterns and core-boxes to allow of the correct angle to the valve-faces, as well as steam-jacketed cylinders, and the correct type of Fowler equilibrium governor. All other "castings" were either cut from the solid or fabricated and silver-soldered.

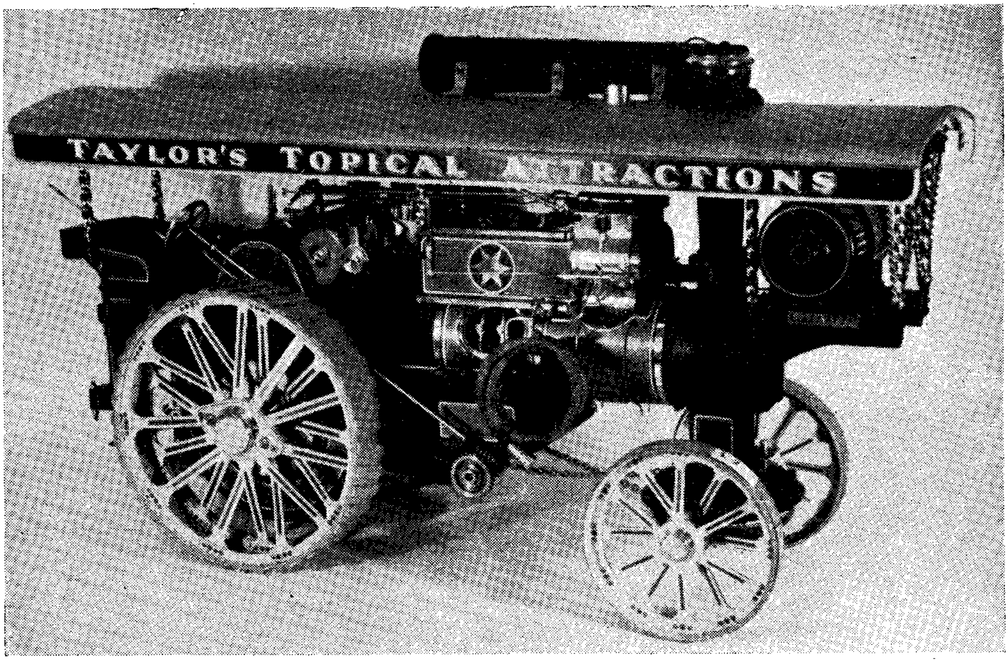
Coal-fired, the boiler was riveted and silver-soldered, with a brazed firebox and girder stays. There are ten $\frac{1}{2}$-in. tubes, screwed and expanded. The working-pressure is 120 p.s.i., and the boiler is fed by both pump and injector.

All unpainted bright parts are of stainless-steel (except for a few nuts and screws) and, of course, this applies to the crankshaft, to which the four split valve-eccentrics are keyed and bolted. Its bearings are in four pieces, being adjustable two ways, and the other bearings have split brasses. There are wick feed oil boxes throughout.

Crossheads of correct appearance are fitted, with gunmetal slippers, and are cottered to taper-ended piston-rods.

Both axles are sprung, the hind axle with the compensated "scissor motion" and compensated coupling, or universal joint, as described in one of my recent articles on the Fowler B6. The three gear-levers are fitted with the interlocking gear, as described in this issue and the compensating gear (differential) may be locked from the footplate.

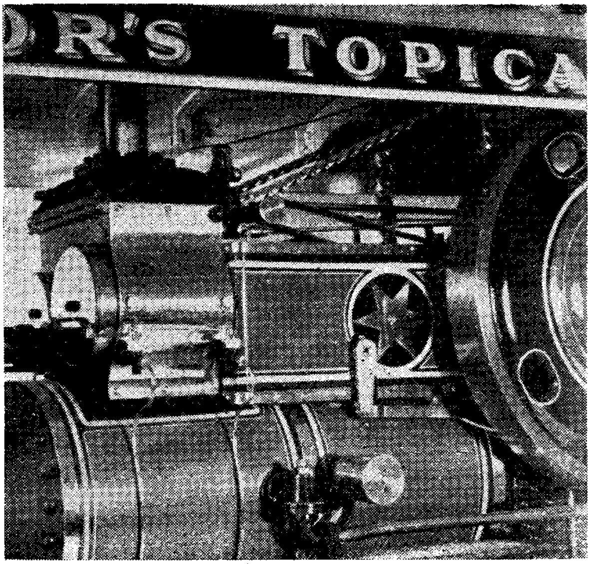
A fan-cooled electric generator of the builder's



Offside view of the Fowler. Part of the canopy roof is removable for ease of driving

own design is mounted on the usual smokebox bracket, delivering 80 W at 14 V pressure, at a speed of 4,000 r.p.m. However, as Mr. Taylor truly stated that the engine's style of finish was as *Supreme*, the last of the Showman's road locomotives, it would have been more correct to have fitted a sheet metal guard between the dynamo and the chimney. And while we are criticising, another point which offended my eye was that *brass* bevel gears were used to drive the governor, instead of steel.

Against these points, though, must be set the remaining magnificently accurate detail work, including even a square thread on the brake spindle, which was perhaps $\frac{3}{16}$ in. in diameter. This certainly was a model which was worth travelling many miles to see!

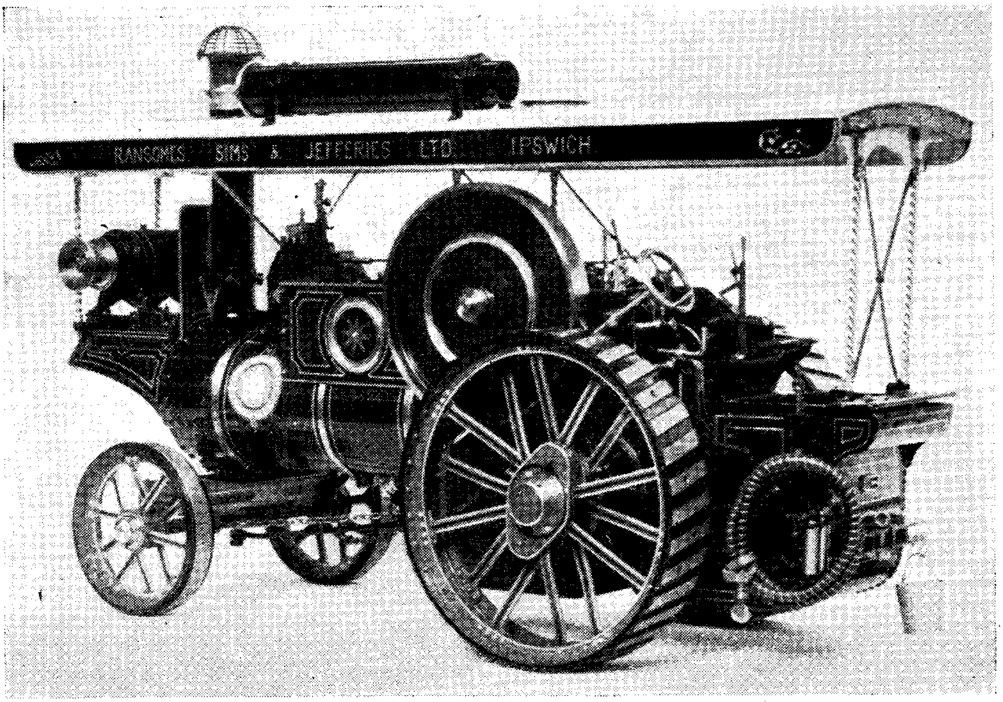


This close-up view gives a good idea of the fine paintwork and brightwork of the Fowler

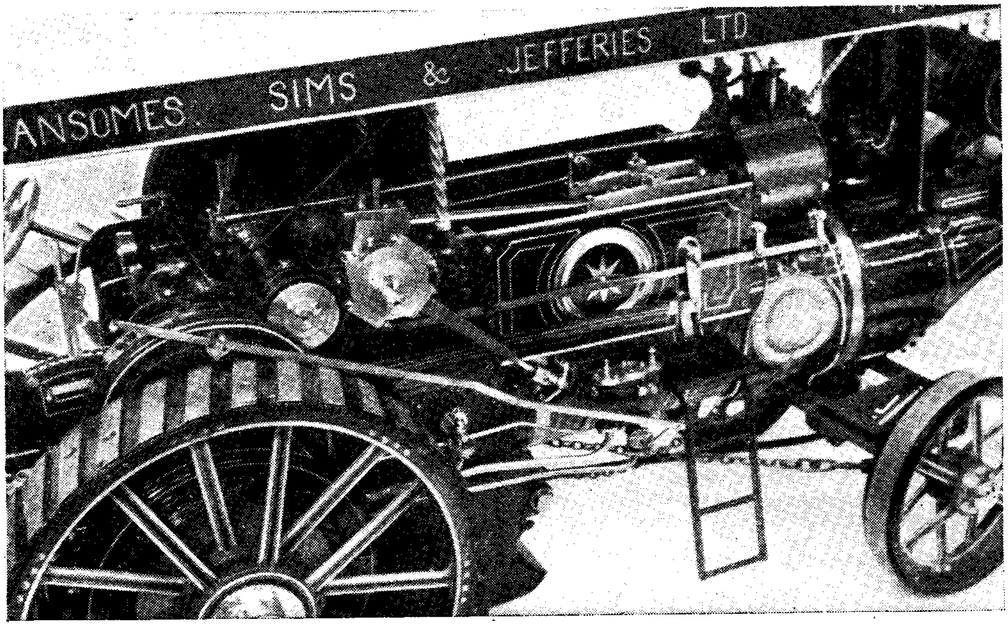
A Ransomes' Showman's Engine

The other silver medallist was A. J. Kent, although I understand that he and two friends collaborated to produce this model. Be that as it may, I shall refer to the builder in the singular, and not in the plural, to save confusion.

To 1-in. scale, the model was of a single-cylindered showman's engine by Ransomes, Sims and Jefferies, and was built to drawings supplied by the makers. Actually, this firm built only one showman's engine proper—that is, a compound road locomotive with showman's fittings—which was in 1908 for Tom Cottrell's "Galloping Pigs." However, in 1911, an ordinary 6 n.h.p. traction-engine, No. 3496, not designed for continuous or heavy haulage work, was fitted with dynamo, extended canopy,



Another silver medallist : the Ransomes' 6 n.h.p. engine to $1\frac{1}{2}$-in. scale



All the detail work on the Ransomes' engine was very true to the prototype

and twisted brass stanchions, for a French customer, and this must be the engine forming the prototype for Mr. Kent.

As with the Fowler model, the detail and finish were really excellent. The paint-work, including the lining and especially the " makers' transfers " on the boiler-barrel, was very well done, though one could wish that the lettering on the canopy had been more showman-like. Compare it with Mr. Taylor's, and you will see what I mean.

The shape of the single cylinder appeared to be just right, and it had the genuine Ransomes' feature of a separate steam-pipe leading from the boiler top to the base of the cylinder-front. The motion-work was very nice indeed, with a correctly cottered big-end and well-proportioned valve-gear. A good representation of a Pickering governor was fitted, but the balls and collars should be steel, not brass. A neat boiler-front, with tiny dummy pressure-gauge and twin sliding fire-doors, added to the appearance, as did the small oil-bottles on the footplate and the bucket hanging from the drawbar.

Other Ransomes features were the footboard and steel step-ladder mounted on the off-side of the boiler, and the steersman's footplate *outside* the tender on the near-side. The steersman's seat was nicely shaped, but should have had the name " Ransomes " fretted out at the back to be truly authentic. Nevertheless, despite the small criticisms, this, too, was a model to make a long journey worth-while.

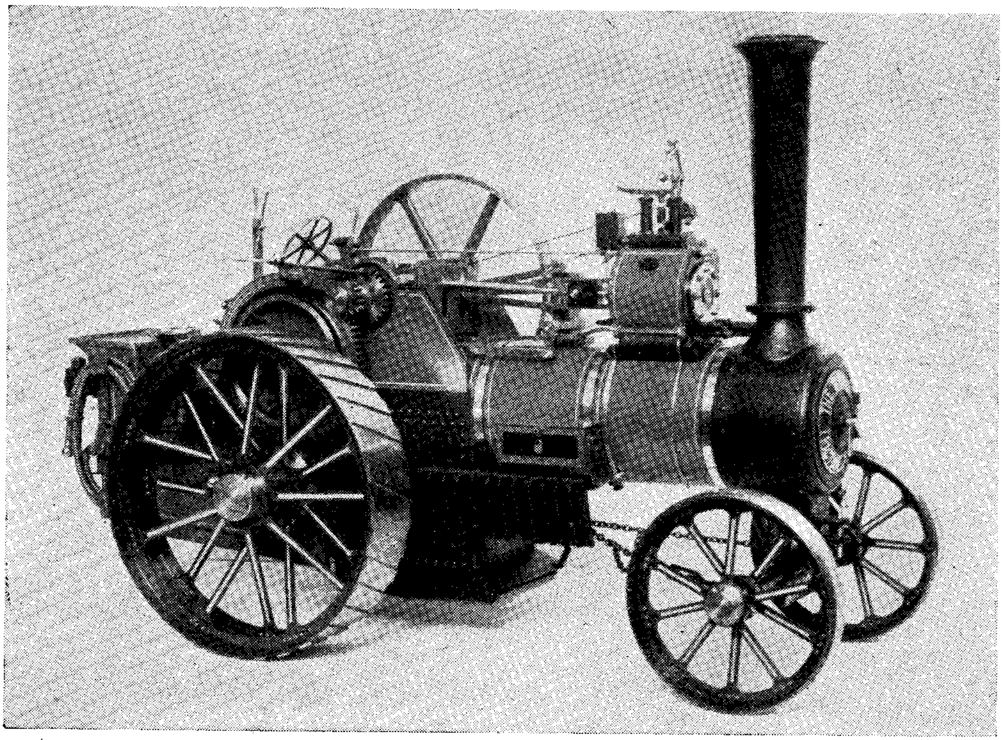
A Single-Cylinder Burrell

The photograph on this page shows the $1\frac{1}{2}$-in. scale Burrell general-purpose traction engine which won a " bronze " for A. L. G. Newman, of Oxford. The prototype represented was an older type of engine, with only single drive on the last motion, instead of the double-drive which the makers used later.

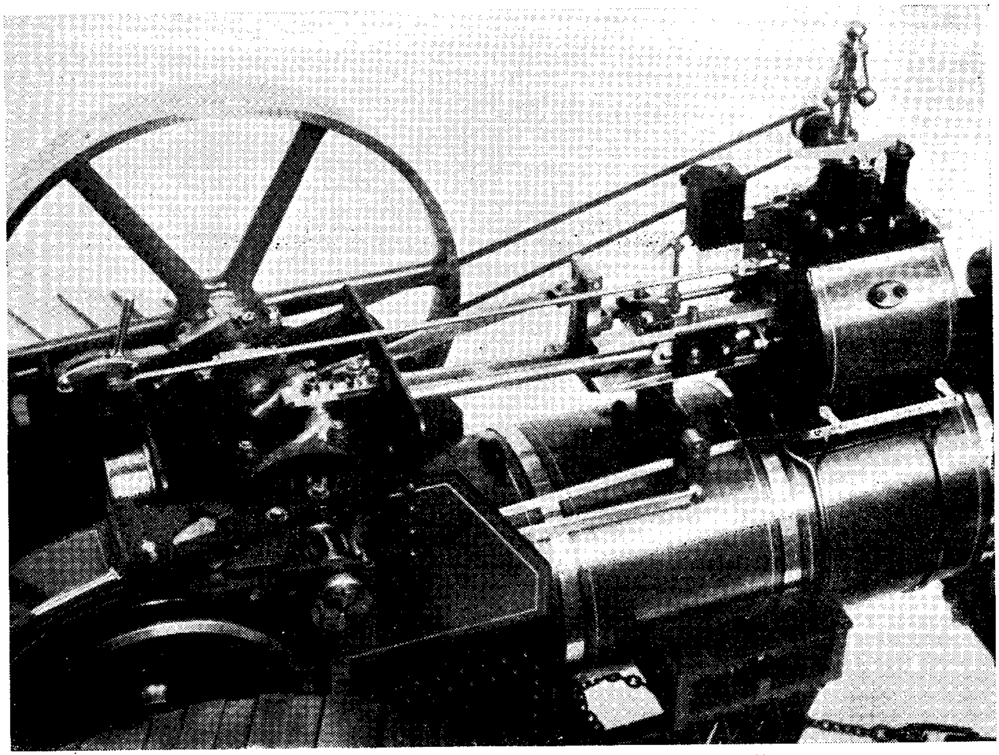
Since this model was well-described by its maker in THE MODEL ENGINEER dated May 22nd last, there is no need for a prolonged description here, but one or two points are worthy of comment.

First, it was good to see that Mr. Newman had painted the engine since the previous photographs were taken, and that moreover the paintwork and lining were so beautifully executed. Secondly, he had replaced the displacement lubricator (formerly disguised as an all-enclosed Burrell-type governor) by a very neat little mechanical lubricator, which looked just right.

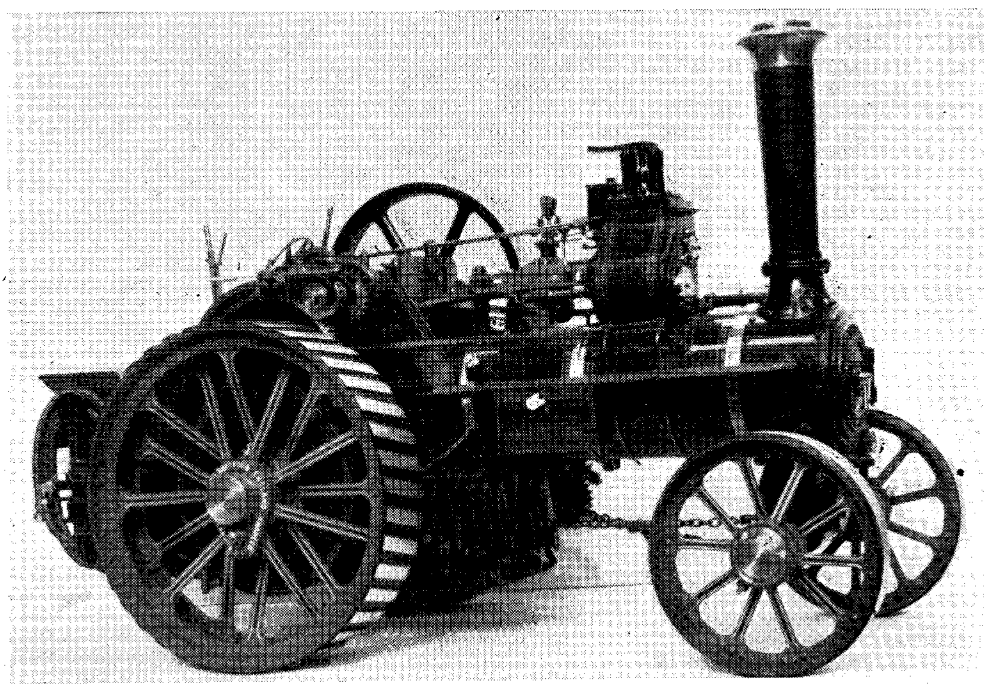
In addition, having thus disposed of the dummy governor, he had replaced this with quite the nicest model Pickering governor I have ever seen in so small a size. Not only did it possess the screw adjustment for varying the governed speed



Yet another engine with a superb finish—A. L. G. Newman's $1\frac{1}{2}$-in. scale Burrell



Controls and motion-work of the single-cylinder Burrell



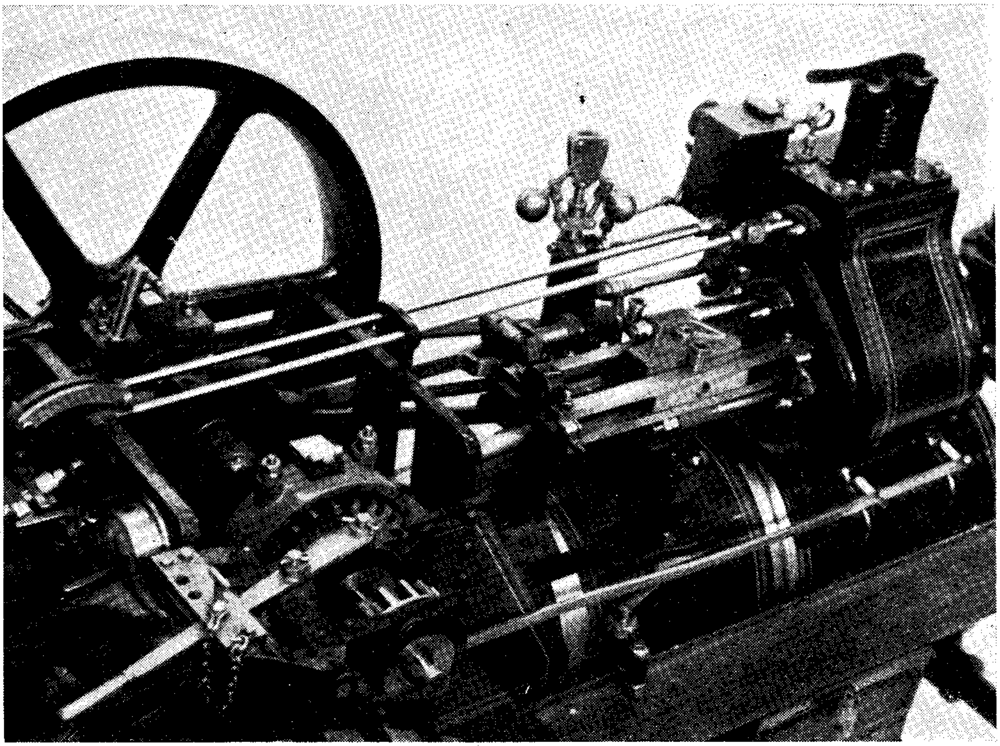
The 1½-in. scale Burrell single-crank compound, which was Very Highly Commended

of the engine, but even the three wire retaining loops which limit the centrifugal divergence of the balls were there.

The two-speed gear, with its well-proportioned interlocking motion, was very nicely modelled, and typical touches which added to the realistic appearance of the model were the wooden-handled coal-shovel and the tiny padlock fitted to the tool-box. But the brake-spindle had a vee-thread; a small detail which one would probably not have noticed had not the Fowler's square thread been seen first!

full-sized job, except perhaps that the thickness of the flywheel rim appears to be a little over-scale. Note the neat cross-arm governor and the mechanical lubricator, as well as the details previously mentioned.

The paintwork, lining included, was not so good as the engines previously described, but there were beautifully modelled raised name-plates on valve-chest cover, rear hubs, and tool-box. The lamps, too, were very good indeed, being fitted with genuine spring brackets (similar to those fitted to the old-type oil-burning bicycle



Note the neat cross-arm governor, and the two piston-rods driving one crosshead, on the single-crank compound

A Single-Crank Compound

Another Burrell model to $1\frac{1}{2}$-in. scale was of their single-crank compound design. This, too, was a general-purpose traction-engine, of the "Devonshire" class, and was built by E. W. Balson, of Southampton.

As many readers will know, in the Burrell single-crank compound the high-pressure cylinder is mounted diagonally over the low-pressure, and both piston-rods drive a single massive cross-head with a single connecting-rod and crank. Similarly, both valve-rods are driven by a single set of Stephenson link-motion. The whole arrangement was faithfully modelled by Mr. Balson, and in fact looking at the close-up of the motion-work (Photograph above), there is nothing to tell one that this is not a picture of the

lamps), whereas those on Mr. Newman's Burrell were only dummy sprung brackets.

Other pleasing detail included the tiny hinges and padlock (with key) to the tool-box, the blast-cock with key correctly fitted on the squared end of the valve-stem, and a very neat steam turret.

This model, unlike Mr. Newman's, was of a later engine double-geared on the last motion. That is, the compensating gear is mounted on the second-shaft, on each end of which a pinion drives a spur-gear directly coupled to each hind wheel. The latter thus revolve freely on a "dead" hind-axle, whereas in a single-motion engine, which is only gear-driven on one side, the axle is "live," and has to drive the wheel on the other side.

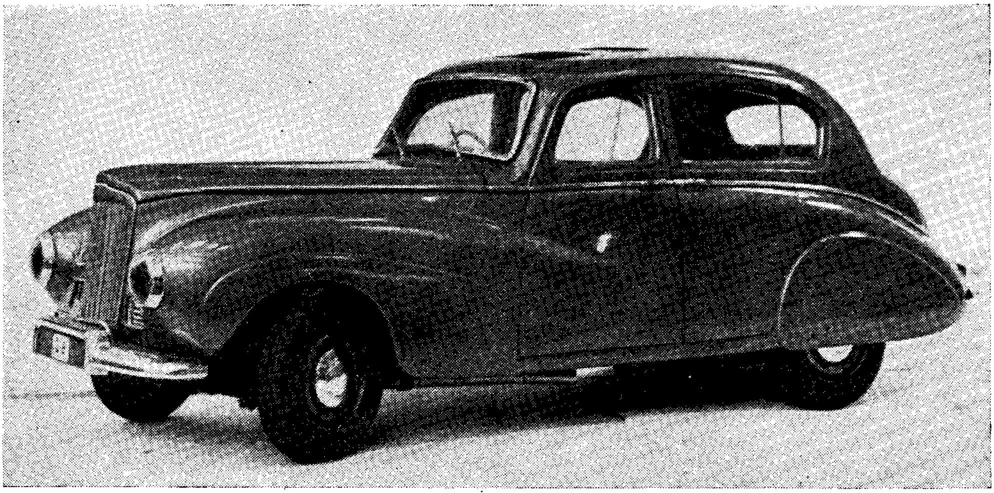
(To be continued)

MODEL CARS
at the "M.E." Exhibition
by C. B. Maycock

THE model cars offered plenty of variety. There was a fully detailed and beautifully made model of a 1935 "P" type M.G. sports car in which the workmanship was of a very high order, and one or two free-lance designs for competition racing in which the workmanship was also very good; several "solids," and to finally whip up the model car enthusiast's interest, Rex Hay's most realistic circuit.

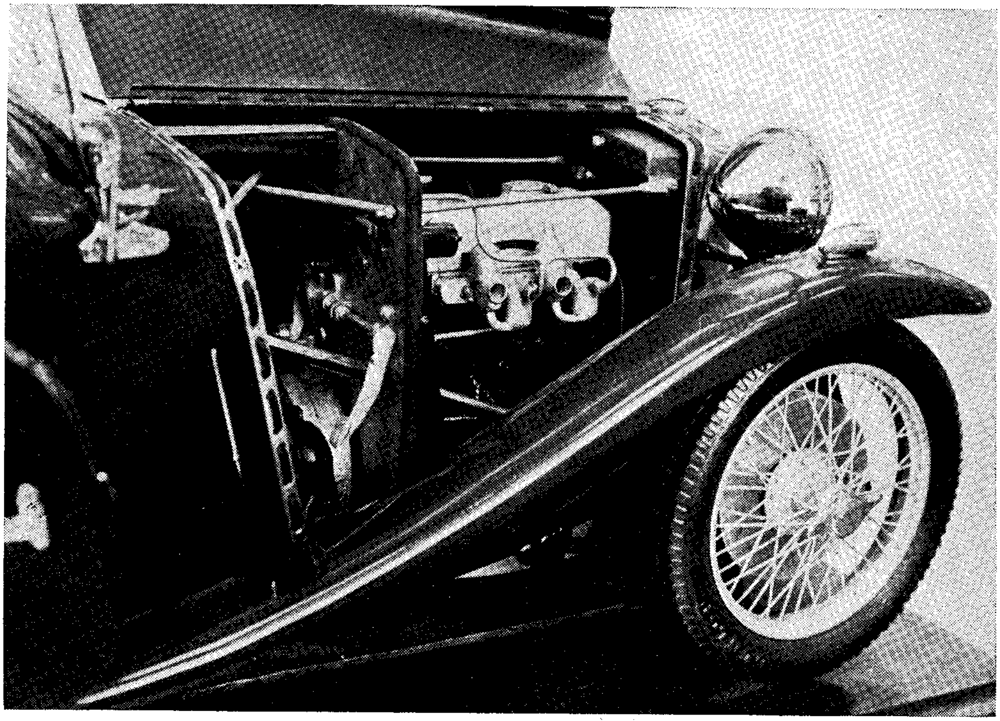
To describe the last mentioned first. This experimental circuit was a real attempt to bring realism to a fine art. Each section of the 380 ft. circuit had its own authentic setting with miniature advertising banners, spectators, and what have you. The pits were a joy, gay with flags of all nations, mechanics and officials, lookers-on and elbow lifters in the refreshment tent, no detail that was relevant was omitted. The cars themselves were a work of art and looked right, one had only to glance at the blown-up photographs lining the walls at the back of the track to discern how closely the models resembled their full-sized counterparts. It takes an artist to capture in a model the subtle characteristics of a racing car so that it is immediately apparent that such and such a car is indeed a model of its prototype. The same applies to locomotives and ships, also, to a slightly less degree, to aircraft. There were six models all told and the track, hardboard on wooden trestles, carried two steel guide rails. On leaving the start the cars climbed a gradient of 1 in 6 for 50 ft. across a bridge over the entrance to the hall and a corresponding gradient into a straight which led into a left-hand turn, doubling back and so on back to the final turn into the pits.

As stated earlier, the track was experimental and it was found that existing methods of securing the car to the track failed under the set of conditions arising, so a special steel-shoe was designed by Mr. Hays and his team, which gave him the complete answer, but unfortunately a little late in the day. One of the Ferrari models so fitted performed consistently and showed not the slightest sign of leaving the track, despite speeds in the neighbourhood of 50 m.p.h. and the car weighing three pounds. The cars represented were H.W.M. Formula II, Ferrari, and Gordini.

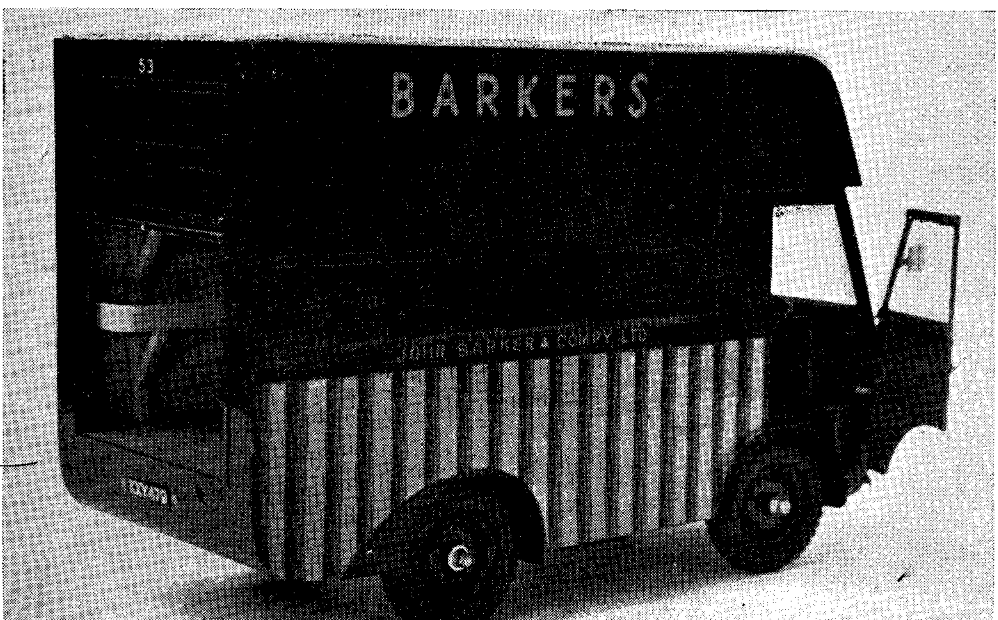


The Sunbeam Talbot 90 with hand-beaten metal body

Under Class "L" in the competition section, a 1/6th scale Sunbeam Talbot "90" was a lovely piece of metal beating and very well finished, a pity the nose wasn't quite right. It should slope or "round off" more sharply to the top of the radiator grille. The 1938 Grand Prix Mercedes was spoilt by poor finish, that all important item which makes or mars any model. Then on the other hand there is the model that is well finished, but poorly designed, one such had everything on it except the kitchen stove. This car in full size would have been a brute to drive blind from every angle except straight ahead; one could not see out of the rear window in reversing; the passengers would be hunched up in the closest proximity to the driver with yards of wasted space in exaggerated overhangs fore and aft. The exhaust pipe stuck well out behind the bumper, so that in backing into a



A close-up of the fully-detailed " P " type M.G. model



An unusual choice of model, an electric delivery van

car park, for instance, it would impale the radiator of the car behind. The sun visor to this car was built on solid so that the air could not escape over the roof, in fact a most efficient air brake. There were many other points that would not make for efficient operation. The main point in voicing this criticism is the hope that a modeller reading this who fancies a free-lance design will draw the job out properly and plan his lines of sight and other practical considerations, because, after all, the model *is* of a mechanically-propelled vehicle on the road, and must face up to road conditions.

A convincing electric delivery van in the proper colours of the owning firm looked most attractive.

In class "M" there was a classic example of high finish on a self-propelled car, a free-lance design based on a Mille Miglia Frazer Nash, and the shade of blue chosen suited this particular model admirably. The Meyer-Drake Offenhauser racing car to 1/5th scale was a fine example of good workmanship. The 1/12th scale Jaguar XK 120 with a fine hand-beaten metal body was spoilt by detail work, especially the number plates.

USING PARTING TOOLS

THE recent article by J. Latta, on lathe parting tools was most interesting, and I heartily endorse his remarks regarding performance. His descriptions of a "deep-cutting weapon" was given very clearly, and obviously it is a success, provided one is careful when sharpening to remove as little as possible of the material in order to safeguard the life of the "nib."

Too little thought is often in evidence in using parting tools, and it is a fact, that one correctly ground and carefully looked after tool, will easily outlast three others made and used in a haphazard manner. A great many breakages are due to a lack of understanding in their use,

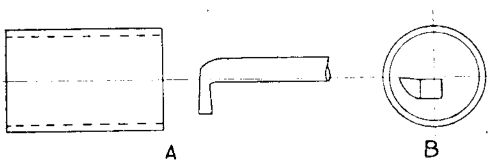


Fig. 1. "A"—parting from the inside; "B"—checking for clearance

and on more than one occasion, I have seen a parting tool break for no other reason than that the operator is "out of sympathy" with his lathe, charging the work unnecessarily. However, these instances are usually attributable to young apprentice engineers of an impetuous nature, rather than to the average model engineer, to whose credit it may be said that caution plays a big part in doing work of this kind.

In my own palmy apprenticeship days we were taught the value of restraint when parting off work—emphasis being laid on the fact that the tool must be given time to cut, relative to the lathe spindle speed in operation.

Perhaps it may be useful to draw attention to the fact that, when parting off thin-walled sleeves, or cylinders which necessitate the tool being very close to the chuck, with sometimes the attendant trouble of the saddle, or toolpost being in danger of fouling the chuck jaws, it is often a great advantage to part off from the *inside*, using a standard boring hook-tool specially ground for parting off. (See Fig. 1.)

I have often made use of this method, with excellent results, and there is no doubt that it is a real time saver, "juggling" for clearance being reduced to a minimum. One need only be careful of depths, etc., in order not to foul the chuck jaws, and, of course, it is necessary when making these calculations to make allowance for the width of the parting tool. It is useful too, to bear in mind, that in the case of a fairly deep parting, it may be possible to employ both inside and outside tools. This reduces to a great extent the risk of tool breakage, which is attendant upon one tool attempting the work on its own.

To hark back to my apprenticeship days, alas, many years ago now, we used to do a certain

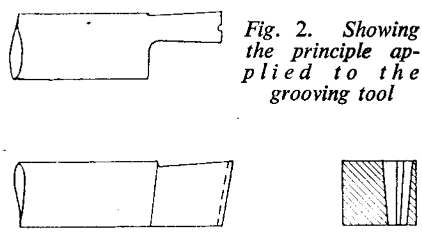


Fig. 2. Showing the principle applied to the grooving tool

job which called for a deep groove, or step, being made on the diameter, the tool in use being very similar in shape to a parting tool, and the work being brass. It was natural that a fair amount of chatter was encountered during this operation, and it was usual to make the tool a bit narrower than the recess required, with a view to working it back and forth till correct width and diameter was reached. It was found, that if a tiny groove was ground in the face of the tool—see Fig. 2—chatter was reduced to a minimum, the tiny "bead" left by the groove being easily removed by reason of the tool being worked from side to side, as stated.

Mr. Latta's observations on the capabilities of a large lathe as compared to a small one are quite correct, and it may be said, somewhat tentatively, that some, but not all of the conditions imposed on a large lathe apply in a small one.

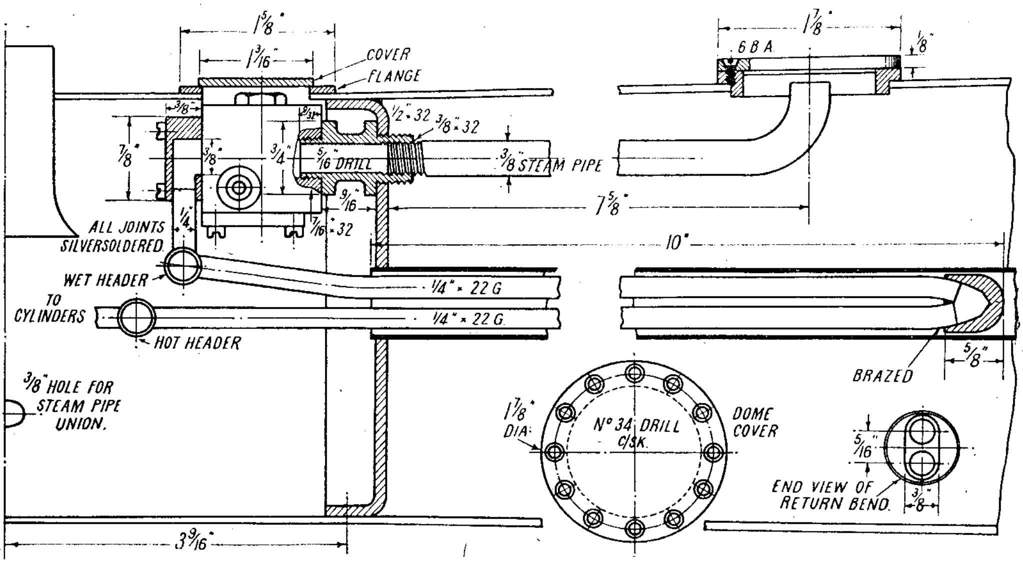
Happy, and perhaps gifted to a certain degree, is the man who can coax a little lathe to do just what he wants, being in tune with its oddities, and obtaining a fullness of pleasure and satisfaction in the work produced.—"SCOTIA."

"Britannia" in $3\frac{1}{2}$-in. Gauge

by "L.B.S.C."

Smokebox Regulator

IF all the naughty things I have said about front-end throttles, the Superheater Company, British Railways (it's a good job Mr. Riddles couldn't hear !) and Inspector Meticulous were coupled together, they would just about reach from Euston to the end of the down main platform at Crewe. The full-size *Britannias* have a front-end throttle, or to give it the "official" title, a multiple-valve regulator, located in the smokebox, and operated by an outside rod, running along the side of the boiler. If I didn't specify a $3\frac{1}{2}$-in. gauge edition of the same box of tricks, the fat would be in the fire, as my old granny used to say ; and the trouble has been to scheme out something that was similar, but workable, and fairly easy to make in the small size. The big engine's regulator is contained in a complicated sort of cored casting, with the superheater headers integral ; and even if that Scottish wizard of the gouge and chisel, Bro. Wilwau, could make a pattern, and cast similar small ones, the valves and operating gear, even if fitted exactly, would be too small for serious work. Well, to cut a long story short, by dint of racking my nearly-worn-out noddle and burning some midnight oil, I managed to solve the problem ; and the result you see in the accompanying illustrations.



The regulator and superheater

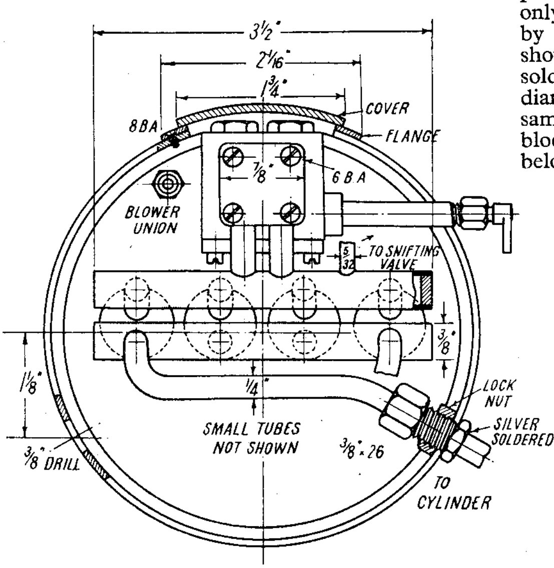
The body of the regulator consists of a block of bronze or gunmetal, with a cavity cast in underneath, for the valve-operating gear, and a boss on the side to carry the regulator spindle bearing, which projects through the side of the smokebox. This block carries two poppet-valves of the same pattern as the full-sized articles the operating gear also being similar ; but both valves and gear are strengthened up to a serviceable size. The valve chambers and the steam ways are easily drilled in the solid block. A specially-shaped distance-piece is screwed into the hole in the smokebox tubeplate, and carries the main steam pipe leading from the dome. The outer end has a male thread, on to which the regulator block is screwed. The valve caps are screwed in, being just plain hexagon-headed plugs, and the cavity underneath is closed by a plate like that on a slide-valve steamchest cover.

The superheater is an entirely separate unit, very similar to those I have specified for the *Lassie*, *Pamela*, and other $3\frac{1}{2}$-in. gauge locomotives described in these notes. A rectangular flange is screwed to the steam outlet on the regulator body, and two vertical pipes connect this with the upper superheater header, which is made of tube. The lower header is similar, the elements (of $\frac{1}{4}$-in. copper tube, with block return bends) being silver-soldered into both. The steam pipes from the lower header are crossed, to avoid sharp bends, and are connected

to the cylinders by unions passing through the smokebox barrel. All connections are plainly shown in the illustrations. As it isn't a practical proposition to fit anti-carbonisers on the small edition, I have added a snifting-valve, which allows the engine to coast freely when steam is off, without sucking ash and grit down the blastpipe; and as the air has to pass through the superheater elements, the cylinders are not cooled off. So much for generalities; now to construction.

Distance-Piece

Our approved advertisers should have no difficulty in supplying castings for the distance-piece, regulator block, and superheater flange; but if castings are not easily procurable (there are



Superheater connections

Britannias being built all over the world, and some builders are in outlandish places!) bar and rod material can be used. For example, the distance-piece can be turned from $\frac{3}{4}$-in. hexagon rod; brass would do, as there is no movement. Chuck in three-jaw, face, centre, and drill to about $1\frac{3}{8}$ in. depth with $\frac{5}{16}$-in. drill. Turn down $\frac{3}{8}$ in. of the outside, to $\frac{1}{2}$ in. diameter, and screw $\frac{1}{2}$ in. $\times$ 32. Open out the end of the $\frac{5}{16}$ in. hole with letter R or 11/32-in. drill, to same depth, and tap $\frac{3}{8}$ in. $\times$ 32. Groove the outside as shown, and part off at $\frac{13}{16}$ in. from the shoulder. Reverse in chuck, and turn down the other end to $\frac{7}{16}$ in. diameter, leaving $\frac{9}{16}$ in. between the shoulders. Screw the spigot $\frac{7}{16}$ in. $\times$ 32, and take a skim off the end, to leave just 7/32 in. projecting from shoulder. A cast distance-piece is machined in the same way, except that it is drilled right through, and no parting-off is required.

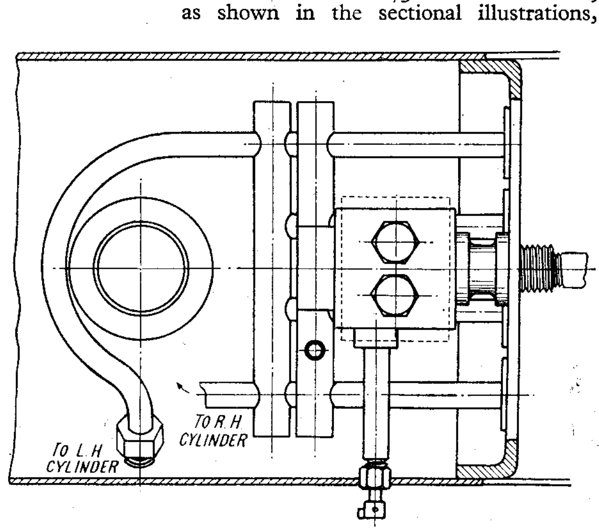
The steam pipe is a piece of $\frac{3}{8}$ in. $\times$ 20-gauge copper tube, with the end bent to a curve as shown, so that when the screwed end is flush with the smokebox tubeplate, the bent end stands approximately in the middle of the dome bush. Anoint the threads on the pipe and distance-piece with a smear of plumbers' jointing, hold the pipe in position, and screw the distance-piece home, as shown. A $\frac{3}{8}$ in. $\times$ 20-gauge pipe should be stiff enough to "stay put" without further support.

Regulator Block

Smooth the casting all over with a file. Should a casting not be available, build up the block, using a piece of brass or gunmetal $1\frac{1}{4}$ in. square and $\frac{3}{4}$ in. thick for the upper part. The lower part would need a piece also $1\frac{1}{4}$ in. square, but only $\frac{3}{8}$ in. thick, with a rectangular hole cut in it by drilling and filing, to the size of the cavity shown in the underside view. This piece is silver-soldered to the upper part; a circular boss $\frac{7}{16}$ in. diameter and $\frac{3}{16}$ in. thick, being attached at the same time in the position shown. The resulting block is then machined up exactly as described below for the casting.

On the centre-line of the side opposite to the cavity, make two heavy centre-pops at 9/32 in. each side of the intersecting centre-line. Chuck in four-jaw with one of these running truly. Open out the pop-mark with a centre-drill, then drill through with No. 14 drill. Open out with 11/32-in. drill and D-bit, to $\frac{3}{8}$ in. depth. Tap $\frac{3}{8}$ in. $\times$ 32 for about $\frac{5}{16}$ in. depth, and poke a $\frac{3}{16}$-in. parallel reamer through the remains of the No. 14 hole. Rechuck with second pop-mark running truly, and ditto repeato operations, but drill through with No. 3 drill, and ream 7/32 in.

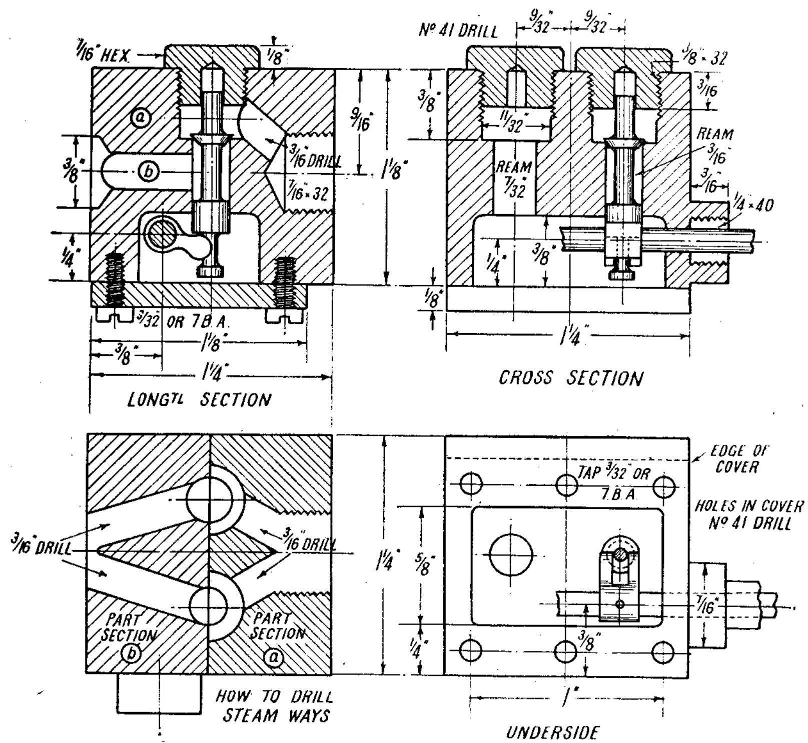
On the face farthest away from the cavity underneath, centre and drill to $\frac{1}{4}$ in. depth with 25/64-in. or letter X drill; tap $\frac{7}{16}$ in. $\times$ 32. From this hole, drill slantwise into the 11/32-in. counterbores, as shown in the sectional illustrations,



Plan of regulator erected

using $\frac{3}{16}$-in. drill. On the facet exactly opposite, mark the centre, make a shallow countersink with a $\frac{3}{8}$-in. drill, and from that, again using $\frac{3}{16}$-in. drill, drill horizontal holes into the spaces under the valve seats, to form the "entrances to the way out." Put the reamers through the vertical holes again, to remove any burring. The holes must be perfectly smooth, or the poppet valves will stick.

The valve caps are turned up from $\frac{7}{16}$-in. hexagon rod held in three-jaw. Face, centre, and drill down to a full $\frac{3}{16}$ in. depth with No. 41 drill. Turn down $\frac{3}{16}$ in. of the outside to $\frac{3}{8}$ in. diameter, and screw $\frac{3}{8}$ in. × 32. Part off a full $\frac{1}{8}$ in. from the but without shake. Then turn the 5/32-in. recess, leaving the spindle a full $\frac{1}{16}$ in. diameter; next turn the second recess, $\frac{5}{16}$ in. long, leaving 5/32 in. of full size between the two. Bevel off the edge of the shoulder nearest chuck, to form the valve contact face; this may be done by slewing the top-slide around to a 30 deg. angle, or a chamfering tool may be used, with the edge ground off to the approximate angle. The *exact* angle doesn't matter a bean, because the contact is little more than a knife edge, the valve forming its own seating when ground in. Leave the valve head $\frac{1}{16}$ in. wide, and then turn down the next 7/32 in. to 3/32 in. diameter; "mike" or caliper a



Details of regulator

shoulder; reverse and rechuck—hold the cap in a tapped bush if you like—and chamfer the corners of the hexagon head. The caps could be made from $\frac{7}{16}$-in. round rod, if hexagon isn't available, and the heads slotted with a hacksaw, for operating with a screwdriver.

Poppet Valves

The valves should be made from rustless steel or drawn phosphor-bronze, $\frac{1}{4}$ in. diameter. Chuck in three-jaw, face the end, and turn down $\frac{11}{16}$ in. length to 7/32 in. diameter. Drill and ream a 7/32-in. hole in an odd bit of metal about $\frac{3}{8}$ in. thick, to use as a gauge; the fit should be easy, 3/32-in. drill for a gauge, again aiming for an easy sliding fit without shake. Finally, part off at 7/32 in. from the valve head, and file a small flat on the stem, to prevent air or steam lock in the hole in the cap when the valves are in place in the block.

The second valve is turned in similar manner, but the guide part is only $\frac{3}{16}$ in. in diameter, and the head is reduced to 7/32 in., as shown in the illustration. If the lathe is "doubtful," or the chuck isn't of proved veracity, the weeny valves can be turned between centres (our late friend "Bro. Iron-Wire's" pet procedure—and not so dusty, at that!) or a very small centre-hole

could be made in the tail or button of the valve, and the tailstock centre brought up to support the job. Anyway, the operation is just a matter of careful turning.

Regulator Shaft

The operating shaft is merely a 3-in. length of $\frac{1}{8}$-in. round rod ; ground rustless steel is about the best, but drawn rustless, or bronze (either nickel or phosphor) will serve, if the first-mentioned isn't available. Same applies to the lifting forks, $\frac{3}{16}$ in. square stuff being required. First slot the end of the piece of rod, for $\frac{3}{16}$ in. depth, with a 3/32-in. cutter, as explained for valve gear forks, and similar pieces. Next, at 9/32 in. from the slotted end, drill a No. 31 hole through the rod, at right-angles to the slot, and make sure that it goes through dead square. File up the forked part to the shape shown, cut off a full $\frac{1}{16}$ in. behind the hole, and round off the cut end. Ream out the holes until they are a tight push fit on the shaft. They are mounted on it at $\frac{9}{16}$ in. centres, but this cannot be done until the shaft is in place, as the forks operate inside the cavity under the regulator block.

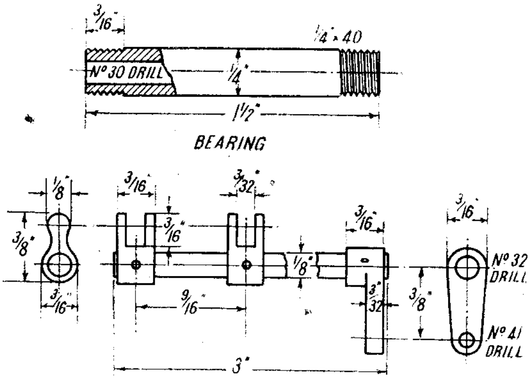
The next job is to mark off and drill the boss on the block for the regulator shaft, and open out and tap it for the bearing. If the boss is correctly located, the hole should come in the middle of it, being $\frac{3}{8}$ in. from the front end of the block, and $\frac{1}{4}$ in. from the bottom. Drill a No. 30 hole right through the boss, into the cavity, using either lathe or drilling machine, as the hole must go through at right-angles to the side of the block. Open out to $\frac{3}{16}$ in. depth with 7/32-in. drill, and tap $\frac{1}{4}$ in. $\times$ 40.

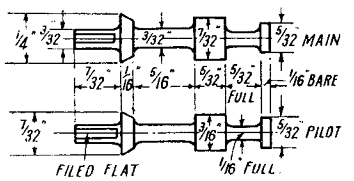
Bottom Cover

The cavity will need a cover, similar to the cover of a slide-valve steamchest. This may be a casting, in which case it will need facing off in the lathe, or it may be just a piece of $\frac{1}{8}$-in. brass plate measuring $1\frac{1}{8}$ in. $\times$ $1\frac{1}{4}$ in. Six No. 41 screwholes are drilled in it, in the positions shown in the underside view of the block. The underside of the block must be trued up, same as I have described many times for truing up port-faces, viz. face off with the block held in four-jaw chuck, and finish by rubbing on a piece of emery-cloth laid on something perfectly flat. The cover must also be trued up. Temporarily clamp the cover to the block in the position shown (see underside view) run the No. 41 drill through the holes in the cover, making countersinks on the block, follow up with No. 48 drill, and tap 3/32 in. or 7 B.A. Smooth off any burr, or you won't get a steamtight joint. By the good rights, there shouldn't be any steam in the cavity, but a few wisps will probably leak past the valve guides, which doesn't matter a Continental.

How to Assemble the Regulator

First of all, the valves will need grinding in—





Valves

Left—Regulator shaft and bearing

a job which will tickle readers who are car owners, and do their own " decoking," like your humble servant. By the way, when I mentioned some time ago, that I could decarbonise the " Morris 12 " engine in $1\frac{1}{2}$ hours, several readers inquired if that included valve-grinding and resetting tappets as well ! Bless their hearts and souls, I haven't yet learned enough of the hidden mysteries and secrets of fairyland, to enable me to do the job by waving a stick over the blessed thing and saying " Ein timmin ongyeiron " or something similar, although one old friend swears to this day that I cured his starter-motor by supernatural power ! But I guess they were pulling my leg, so they are freely forgiven. However, getting back to the weeny valves, all they need is a trace of grinding paste smeared on the bevels ; a scraping off your oilstone is as good as anything. Then insert into the holes in the regulator block, and twirl them back and forth a few times, alternately pressing lightly and lifting. A couple of inches of copper or brass tube, just big enough to push tightly on to the top guide spindles, makes a nobby grinding tool. All the grinding needed, is just sufficient to take the sharp edge off the D-bitted valve seating, and bed the valve on to it. The narrower the contact, the more likely it is that the valve will remain steamtight. Be mighty careful to clean both the valves and seatings afterwards ; then replace the valves, and screw the caps in, with a smear of plumbers' jointing on the threads.

Turn the block upside down, and insert the shaft through the hole in the boss at the side. Put a fork on the bottom of the valve spindle

nearest the boss, as shown in the illustrations, and push the shaft through the hole in the fork; then ditto repeato operation on the other valve. The shaft should just show through fork No. 2. Now adjust the two forks on the shaft, so that they are a little out of line, and the smaller valve lifts a bare 1/32 in. or so before the larger one. This is why the lifting ends of the forks are smaller than the recesses in the valves; if they fitted, both valves would lift together, and it would be next door to impossible to start the engine under load, without causing her to lose her feet and slip like nobody's business. The Southern spam-cans are real lassies at that antic! With the small valve cracking first, the engine will be able to get off the mark without any slipping at all. The pressure just builds up on the pistons, and pushes at them gently until they move. When the forks are correctly adjusted, drill a No. 53 hole through fork and shaft, and squeeze in a stub of $\frac{1}{16}$-in. wire filed slightly taper at the end, to enable it to start easily in the hole. The cover plate is then attached, putting a joint gasket of thin oiled brown paper, or 1/64-in. Hallite or similar jointing, between cover and block. Secure it with half-a-dozen 3/32-in. or 7-B.A. cheesehead screws.

Erection

The erection is a simple matter; just anoint the projecting screwed spigot on the distance-piece on the smokebox tubeplate, with a smear of plumbers' jointing, and screw the regulator block on to it. The block, when right home, should stand vertically, as shown in the end view, with the regulator shaft horizontal. If it doesn't, put a copper washer between the flange on the distance-piece, and the block, so that the block is quite tight when in the correct position. It will screw on quite readily before the smokebox is fitted, there being nothing to prevent it turning, as it is clear of the tubeplate flange. The bearing can then be made; this is just a $1\frac{1}{2}$-in. length of $\frac{1}{4}$-in. round rod (brass will do if nothing better is handy) drilled through with No. 30 drill, and screwed $\frac{1}{4}$ in. $\times$ 40 at both ends. The gland nut is just the same as a union nut and needs no description; it is made from $\frac{5}{16}$-in. hexagon brass rod. The bearing can be just temporarily screwed in place for the time being; it isn't attached permanently yet, as the smokebox couldn't be fitted with it in place. The little crank on the outer end of the regulator shaft might also be made at this stage; the sizes are given in the illustration, and the construction is same as described for valve gear cranks, viz. the flat part is cut from 3/32-in. steel, and the boss brazed on and drilled. If it is just put temporarily on the end of the shaft, and move by hand, the regulator should operate, the smaller valve lifting just a little before the larger one. Next stage, superheater.

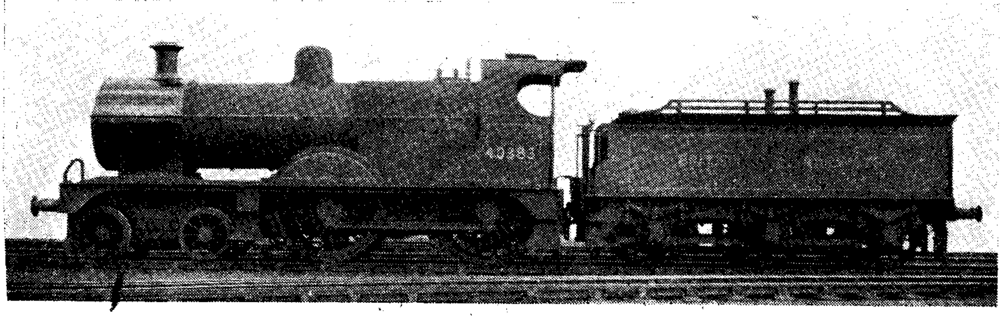
LAST OF THE CLASS

Locomotive No. 40383, the last of the old Midland Railway 4-4-0 non-superheated Class 2 passenger engines, has been withdrawn from stock for breaking up.

Designed by S. W. Johnson and built in 1888, this engine was one of a batch of ten, the original numbers being 1808 to 1817. She had 6 ft. $6\frac{1}{2}$ in. diameter coupled wheels, 18 in. $\times$ 26 in. cylinders and a "B" class boiler with a working pressure of 160 lb. per sq. in., giving a tractive effort of 12,960 lb. A larger "H" class boiler with a working pressure of 175 lb. per sq. in. was fitted in June 1904, raising the tractive effort to 14,487 lb.

In 1907 these ten engines were renumbered 378-387 and the entire class was later rebuilt by Henry Fowler, No. 383 being dealt with in 1909. A G.7 boiler was fitted but the working pressure and tractive effort remained the same. At nationalisation only two of these locomotives remained in stock, and these were renumbered 40383 and 40385. No. 40385 was withdrawn from stock in 1949.

The total mileage run by No. 40383 was 1,604,149 and her last years were occupied in pulling the Derby District Engineer's saloon on inspections round the district.



A SMALL ELECTRIC MUFFLE

by "Duplex"

IN most workshops, various small tools and machine components have, from time to time, to be hardened and tempered ; for example, home-made cutters and joint-pins made of carbon-steel.

The ordinary brazing hearth, equipped with a blowlamp or a gas blowpipe, is commonly used for this purpose, but the temperature of the work is often raised much too quickly and it may not be uniformly heated throughout. Moreover, even when the work is protected with firebrick, it is possible that some portions may be subjected to the full heat of the flame and become partially decarbonised or, as it is termed, burnt.

The ideal, therefore, is to raise the temperature evenly and somewhat slowly and, at the same time, it should not be possible for the temperature of any part of the work to be raised above the required hardening point.

Nowadays, all serious heat treatment of steels of various kinds is most often carried out in a muffle furnace, heated either by gas or electricity. Electricity has the advantage of not producing fumes that may have a deleterious chemical action on the work under treatment.

Commercial electric muffles are usually fitted with a pyrometer for registering the temperature within the furnace, and an automatic control is also provided for maintaining the temperature at the required level. However, these accessories add greatly to the initial cost, so that it may be prohibitive as far as the amateur worker is concerned. With this in mind, it was decided to build a simple type of experimental muffle, using as far as possible components and materials in everyday use. At any rate, local overheating of the work would not be possible and, in this respect the furnace would be an improvement on the gas blowpipe.

The Heating Element

For the source of heat, a standard, 750 watt, bowl fire element was chosen, and it was decided to make use of the hollow centre for the heating chamber ; this cylindrical cavity in the finished muffle measures $\frac{7}{8}$ in. in diameter and $2\frac{1}{2}$ in. in length. The heating chamber, although small, is adequate for dealing with small tools and serves well for experimental purposes. To adapt the element for use in the furnace, the wire coil is first removed, and the body is then mounted on a stub mandrel to enable the bulbous end to be faced off in the lathe ; at the same time, the mouth is flared internally, and a register shoulder is machined at this end to fit against the framing carrying the furnace door.

The details given in the drawings should make clear what is required. There is no great difficulty in machining the ceramic material in the lathe with an ordinary turning tool, but it is advisable to cover the working parts of the lathe, as a great deal of dust is produced.

At its rear end the standard ceramic body is fitted with two connectors for supporting the fitting when it is inserted in the base of its plug-connector. However, to obtain a larger ventilating

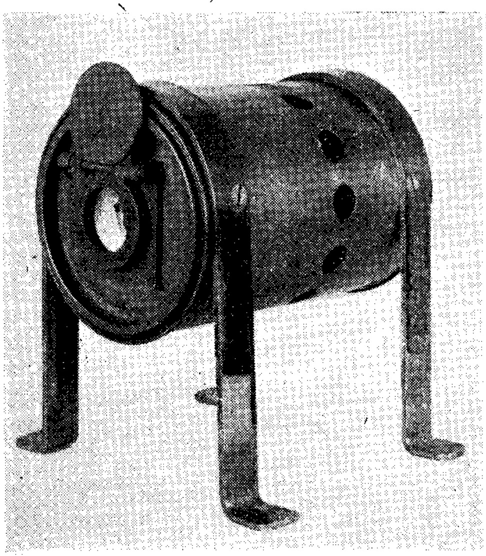


Fig. 1. *The finished furnace*

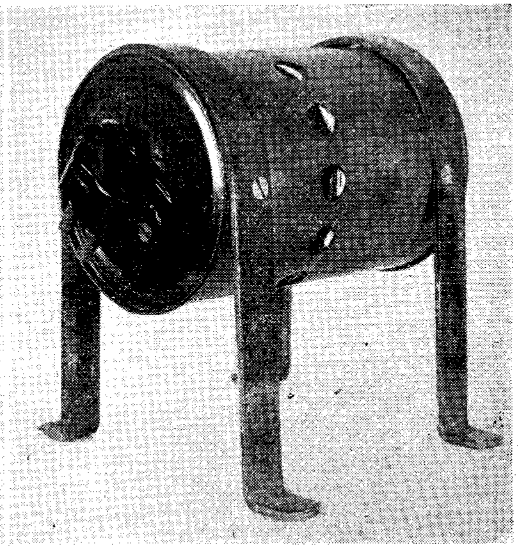


Fig. 2. *Back view of the muffle*

space at the back of the furnace, these connectors are furnished with extension-pieces made from $\frac{3}{8}$ in. × $\frac{1}{16}$ in. brass strip, as shown in the drawings. These connecting strips are held in the body by means of the standard binding-screws and, at the other end, the two cylindrical plugs engage in the base of the plug-connector and serve to support the rear end of the element. In the ordinary bowl fire the return lead of the wire heating coil is brought back through the hollow centre of the body, but as this cavity now forms the heating chamber of the furnace, the lead in question is returned to the rear by means of the external extension bar shown in the special punch can be used to remove the surplus metal, before the opening is finally filed to shape so as to be well clear of the live leads.

The lid of the container forms the front of the furnace and serves to carry the frame of the fire door.

The central hole in the lid can be cut out with a piercing saw, and during this operation the work should be clamped in the vice between two pieces of wood in order to give the necessary support.

If, at the final assembly, the lid is not found to be a tight press-fit, it can be secured by supporting the rim on a wooden block and then,

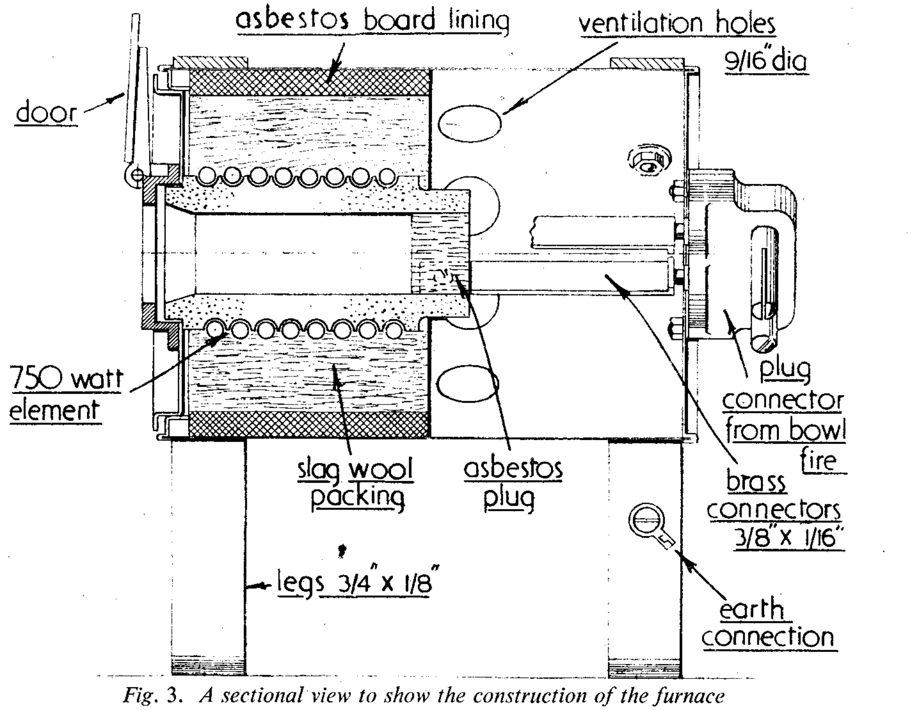


Fig. 3. A sectional view to show the construction of the furnace

the drawing. To complete the alterations made to the element, an asbestos plug is fitted to seal the inner end of the heating chamber ; this plug serves both to retain the heat and to insulate the wiring connections from contact with the work.

For the canister, forming the cylindrical body of the muffle, a large, household tin was used, measuring 4 in. in diameter and $5\frac{1}{2}$ in. in length. To prevent unnecessary heating of the rear end of the furnace, a series of ventilating holes is punched in the canister. This operation can be carried out without deforming the tin if a special tool is employed, consisting of a circular punch and die block pressed together by means of a central draw-bolt. The construction and application of this tool were described in THE MODEL ENGINEER of November 22nd, 1951.

A hole is also required for mounting the plug-connector on the back of the canister and, again, from the outside, indenting the wall of the canister with a centre punch.

The door frame was made from the cast-iron lid of a disused switch box, bored out at its centre to fit the shoulder turned on the body of the element ; at the same time, the 1 in. dia. fire hole is also machined. The frame is secured to the canister lid by two bolts, as well as by the two eye-bolts forming the door hinge. The fire door is a steel or cast-iron disc, hung to fit closely when the hinge-pin is finally fitted.

When the furnace is in operation, it will add to the convenience of working if the door is furnished with an inspection window. The construction of this fitting is illustrated in Fig. 7. The central boss of the door is bored to form a shoulder, and a mica disc, after being cut to size, is retained in place by means of a split-ring. Mica is a rather difficult material to shape neatly owing to its laminated composition; but, as

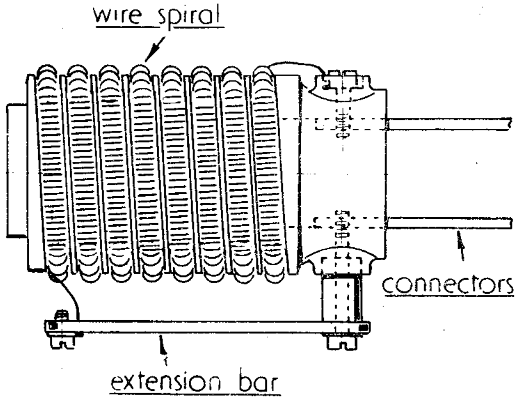


Fig. 4. The modified element and its electrical connections

represented in Fig. 8, a satisfactory job was made by placing the mica sheet on the door and then using the vice to press in a short length of round rod to act as a punch.

The Stand

The four legs on which the furnace stands are made by bending two lengths of $\frac{3}{4}$ in. × $\frac{1}{8}$ in. mild-steel strip to the shape shown in the photographs; the material is then attached to the canister with small, countersunk screws and nuts.

For convenience of working, it is advisable to make the rear legs a little shorter than those at the front so as to give the furnace a backward tilt. The turned-up feet are drilled for attachment to a baseboard, and a screw hole is provided in one leg to make the earthing connection, as this is essential for safe working in an electrical apparatus of this kind.

In order to insulate the container so as to maintain the heat, as far as possible, within the heating chamber, a sheet of asbestos millboard, $\frac{1}{4}$ in. in thickness, is fitted as a lining. This material is more easily fitted in place if it is first softened by soaking in water.

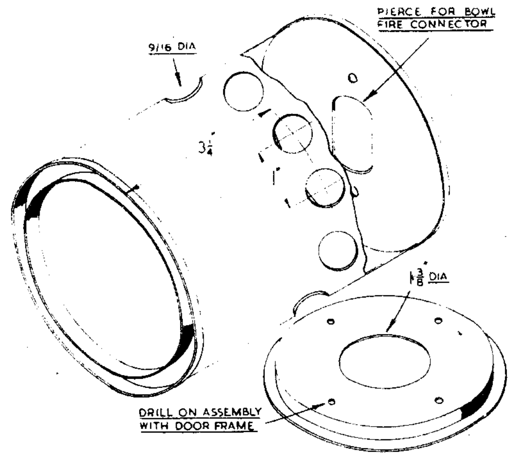


Fig. 5. The container with its lid

Next, after the element has been fitted into the plug-connector, the intervening space is filled with slag wood, packed fairly closely; this material can be removed with less difficulty than asbestos meal, when it becomes necessary

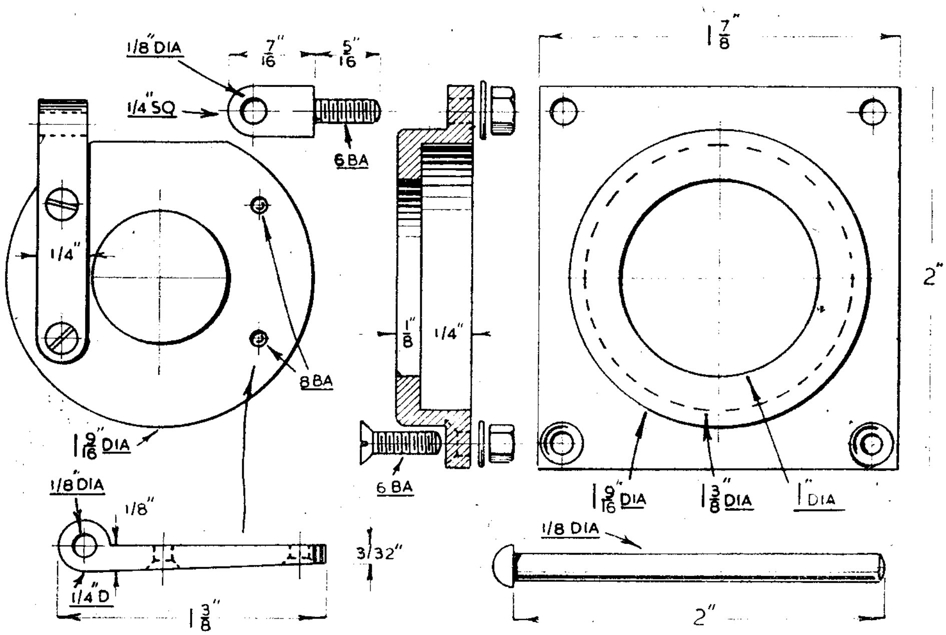


Fig. 6. The fire door with its frame and hinge

to replace the wire spiral of the heating element. When the lid has been pressed into place and, if necessary, secured in the way previously described, the furnace can be connected to the mains and given a preliminary trial.

Controlling the Furnace

It is advisable to fit the furnace with some form of temperature control, so that once the full temperature required has been reached, the heat can be maintained without further attention. For this purpose, some form of variable series resistance, such as a sliding rheostat, can be used, but this is wasteful of current, as energy is dissipated in heating the resistance wire.

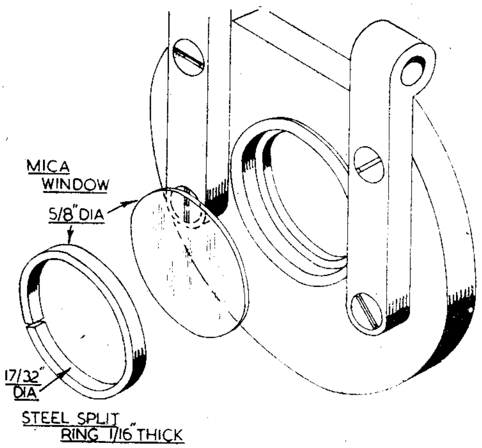


Fig. 7. Method of fitting an inspection window to the fire door

Nowadays, domestic appliances, like cooking ovens and boiling rings, are usually controlled by means of a fitting known as a Simmerstat, manufactured by Messrs. Sunvic Controls Ltd. This ingenious instrument consists of a small thermostat, consuming a negligible amount of current, connected to a quick-action on-off switch. The duration of the electrical connection to the heating element in the furnace is varied by turning the control knob, as this controls the setting of the automatic switch operated by the thermostat.

The Simmerstat illustrated in Fig. 9 has been enclosed in a casing made from a discarded switch box. A connector for a 3-pin plug is

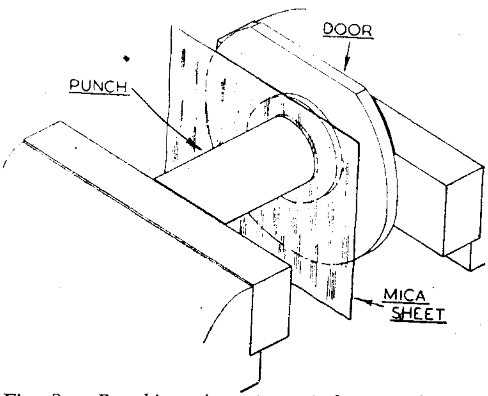


Fig. 8. Punching the mica window in the vice

attached to one end of the box and, at the other end, the lead for supplying the furnace is carried through the casing.

In addition, a small, neon signal lamp with a red cover is mounted on the front of the box to serve as an indicator that the switch is closed. The control box can either be mounted on the furnace baseboard, or it can be kept as a separate unit for use with other electrical appliances.

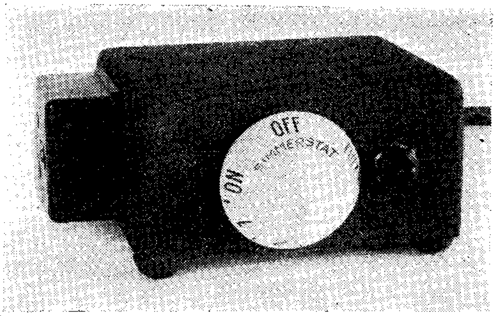


Fig. 9. The Simmerstat in its casing, showing the signal lamp and electrical connections

The small, experimental furnace has already proved its usefulness in the workshop and, if suitable components can be obtained, this may lead to making a larger and more ambitious furnace capable of dealing with a wider range of work, including, perhaps, case-hardening and hard-soldering.

Garner's 1953 Buyer's Guide

This handy little booklet, submitted to us by Messrs. T. Garner & Son Ltd., Redbrook Works, Gawber, Barnsley, Yorks, consists of a comprehensive catalogue of hand and machine tools, and general workshop equipment, giving current prices of all items. These include a full range of Myford lathes and accessories, also "Little John," Portass, Harrison and other lathes; drilling machines by Pacera, Kerry and Champion; also, milling machines, power grinders, electric hand tools, chucks, woodworking machinery, etc. Particulars are given of the Garner Personal Hire Purchase Plan, with application form enclosed.

The booklet can be obtained from the above address, price 1s. per copy, this sum being refunded to the customer on any purchase made.

"Talking about Steam——"

by W. J. Hughes

12.—The Fowler "Big Lion" Road Locomotive

THE driving arrangements for the hind wheels of the "Big Lion" are very similar to those of the Davey Paxman engine, of which a detailed and illustrated description was given in THE MODEL ENGINEER dated March 13th, 1952. I do not propose therefore to deal at length with them, except to note one or two slight differences.

First, there is no brake drum on the hind axle of the Fowler; the brake shoes work on large angle rings which are clipped to the spokes of the hind wheels, as may be seen in the general arrangement drawing.

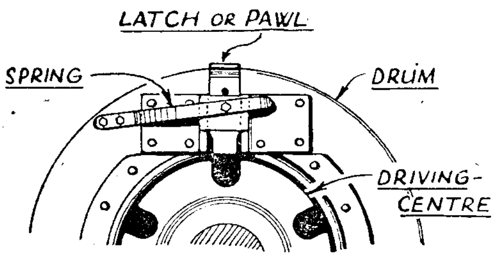


Fig. 43. *Method of driving winding-drum, as explained in the text*

Secondly, the latch which locks the winding drum to the left-hand driving-centre is different, as shown in Fig. 43. It slides in or out in a radial groove built on the side of the drum, engaging with one of the slots into which the driving-pins fit.

And thirdly, the compensating (differential) gear is locked by means of two long pins passing through holes in the lobes of the hub of the right-hand wheel, instead of the shorter pin shown on the Davey Paxman engine. (It should be mentioned that earlier Fowlers had only the single-lobe hub as shown in Photograph No. 12; and also that some later ones were fitted as an extra with a locking device which could be operated from the footplate.)

Change-Speed Gear

The three-speed gear of the "Big Lion" incorporates an ingenious interlocking device to ensure that two speeds could not be engaged at the same time, perhaps by some driver who had appeased his thirst not wisely but too well. But let us see, first, how the three speeds themselves were arranged, for which it will be necessary to consult the general arrangement drawing once more, in the issue for October 16th.

Four splines are machined on the right-hand end of the crank-shaft, and the slow-speed pinion slides on these to engage with the slow-speed spurwheel mounted on the second shaft.

In the case of the second or "fast" speed, the pinion is keyed to the crankshaft, just inside the left-hand bearing, and it is the spurwheel which slides in and out of engagement with it, on splines machined on the second shaft.

The third or "extra-fast" gears are mounted between the left-hand hornplate and the flywheel, being shown in dotted lines in the plan. This time the spur-wheel is keyed to the second shaft, and the pinion slides on splines cut in the crank-shaft once more.

Each sliding wheel has a grooved collar, with which a fork engages; each fork has a dovetail-section arm which slides in a dovetail groove machined in the cap of the main-bearing adjacent to it.

A vertical pin in each arm engages with a slot in the appropriate operating lever, the fulcrums of the levers being vertical pins mounted also on the main-bearing caps.

Interlocking Gear

The operation of the interlocking gear is shown diagrammatically in Fig. 44, which is reproduced from my book. The three operating-levers are shown in end-elevation, or rather in cross-section, at *A*, *E*, and *F*; in addition, there

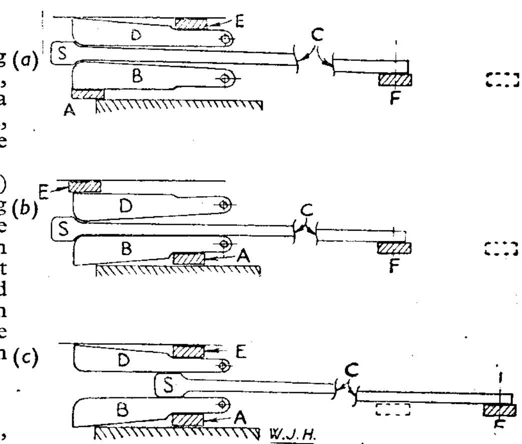


Fig. 44 (*a*), (*b*) *and* (*c*). *The Fowler interlocking arrangement for the three gear-change levers, patented in* 1899. *See text for details*

are two latches *D* and *B* and the interconnecting-rod *C*, which has a "bulb" or swelling (*S*) at one end, and is pinned to *F* at the other.

In Fig. 44(*a*), the levers are set as in the plan of the general arrangement, with second speed engaged; now latch *D* prevents *E* being moved

to the left to engage third speed, and bulb S prevents F being moved to the right (to the position shown dotted) to engage first speed.

But if A is moved to the right to disengage second speed, then B will drop, as will S and D, as shown in Fig. 44(b). Then lever E can be moved to the left to engage third speed, as indicated.

Alternatively, if A and E are *both* left in the disengaged position, then lever F can be moved to the right to engage slow speed. This brings bulb S between D and B, as shown in Fig. 44(c), and thus prevents either E or A being moved to the left.

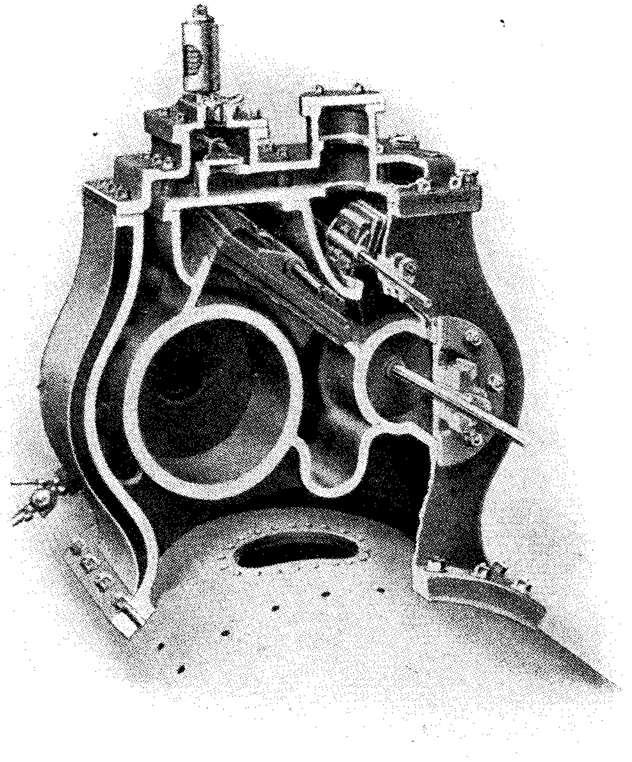


Fig. 45. In this section through a Fowler cylinder-block, the arrangement is very similar to that of the "Big Lion." Note that valve-faces slope both inwards and forwards

Of course, with all three levers in the neutral position, the locomotive could be used as a stationary engine for generating electricity, or for any other purpose that her owner might desire.

Cylinders

Fig. 45 will be useful in helping to understand the arrangement of the steam passages in the Fowler compound cylinder-block, though it must be emphasised that it does *not* show the "Big Lion" cylinders, but those of a smaller tractor. Nevertheless, the block has much in common with the "Big Lion."

It is not suggested, naturally, that the model engineer would need or be able to make the complicated patterns and core-boxes which would be required to produce a more or less accurate replica of the prototype block internally, but if he knows how the passages are arranged in big sister, it should help him to wangle them in his smaller edition. In the next article, I propose to include some drawings and photographs to show how other people have tackled this problem.

Talking of castings, by the way, I can now reveal the good news that, at my instigation, Bro. Reeves of Birmingham is preparing some for the "Big Lion," and that in fact those for the cylinder, valve-chest, and cylinder-cover are now ready. But more of these next time—let us return to the steam-ways!

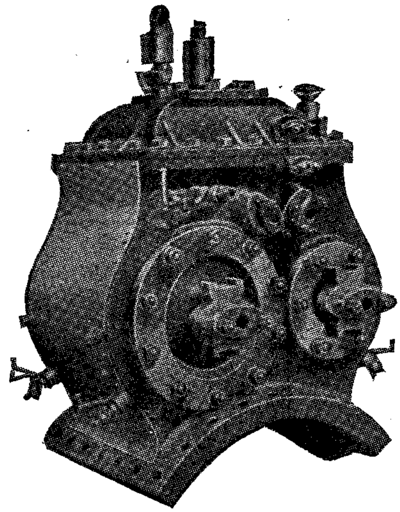
Steam Passages

The steam leaves the boiler through the circular hole, which is reinforced by a strengthening ring riveted on, and passes up passages cast outside the cylinders to the "dome," on which the two Ramsbottom safety-valves are mounted. The valves are held down by a lever which is itself held in place by a central spring, brass-encased.

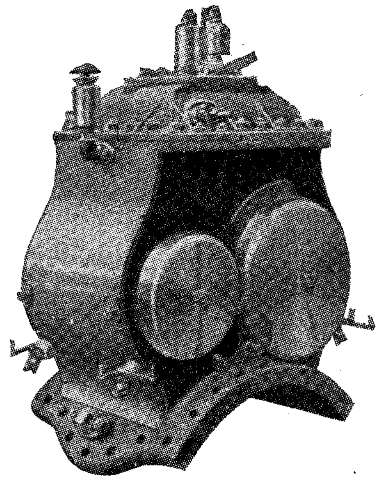
In Fig. 45, the safety-valves are shown to the left of the cover, with the regulator-valve immediately below. In the "Big Lion," however, the safety-valves are central, with the regulator more to the right, as will be seen in the general arrangement drawing. Another difference in this illustration is that it shows the housing for a Pickering-type governor, though no governor is actually fitted and the upper opening is blanked off.

However, the steam passes from the dome through the regulator-valve (when it is open!), then along the cast-in passage to the governor-valve, and down into the high-pressure valve-chest on the right. Having done its work in the high-pressure cylinder, it is exhausted into the chamber immediately below the H.P. valve-chest, but above the H.P. cylinder.

This chamber communicates with the L.P. valve-chest, and combines with it to form a receiver for the H.P. exhaust steam. (It must be remembered that the volume of the receiver should be equal to or greater than that of the H.P. cylinder, since the H.P. exhaust steam has to "wait" for the L.P. slide-valve to open. A



Courtesy] [J. & H. McLaren Ltd.
Fig. 46. Front end of cylinders: note whistle, enclosed safety-valve spring, and glands for regulator-rod and valve-rods



Courtesy] [J. &. H. McLaren Ltd.
Fig. 47. Chimney end of cylinders: note boiler filling-plug, displacement lubricator, end of regulator-rod, and exhaust-orifice

smaller volume would cause back-pressure in the H.P. cylinder.)

When the steam is exhausted from the low-pressure cylinder, it passes into the central chamber between the cylinders, and thence out through the exhaust-pipe, the orifice of which may be seen at the back of the chamber. It will be obvious from this diagram that the cylinders themselves were completely steam-jacketted, which was a contributory feature to the well-known Fowler reputation for economy in coal and water. In passing, we may remark that Fowlers were the pioneers of compounding for traction-engines, in 1881; failure was predicted for this innovation, and it was several years before other makers followed, the next being Fodens.

Simpling-Valve

In Fig. 46, we see a fitting on the left of the block, above the L.P. cylinder-cover. This is the simpling-valve, whereby high-pressure steam may be admitted to the low-pressure valve-chest. With steam at full boiler pressure working on the large area of the L.P. piston, as well as on the H.P. piston, a tremendous surge of power is the result, so that to start an extra-heavy load or to deal with any other emergency was easy.

The reader will recall that in the last article I mentioned that Mr. Coombe used the simpling-valve on *Queen Mary* when hauling the 40-ton crane out of its predicament.

The valve is operated by a push-rod from the footplate, with a return-spring to prevent misuse;

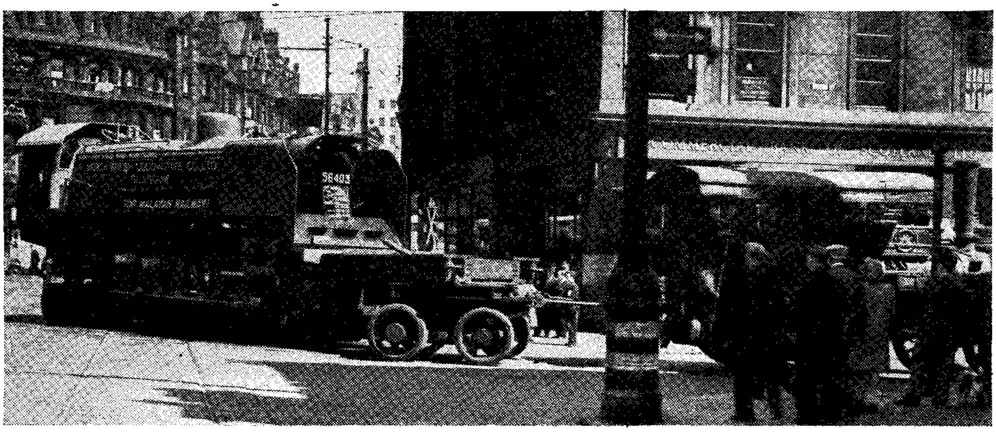


Photo by courtesy] [North British Locomotive Co. Ltd.
Photograph No. 15. "Supreme," last built of the Fowler road locomotives, hauling a Pacific type locomotive to Glasgow Docks en route to Malaya

but it was not unknown for a driver to tie the button down with a piece of string or wire on occasion!

Another Job of Work

Photograph No. 15 shows another typical job of work undertaken by a Fowler Lion, and is of especial interest because it shows *Supreme*, the last of the line of "Super Lions." Built for Mrs. Deakin as a showman's engine—or should we say show-*woman's* engine?—the locomotive later became the property of Messrs Road Engines and Kerr, of Glasgow; her dynamo was removed and canopy cut down, and she was used on such tasks as that depicted.

Subsequently, after being unused for a time, she was purchased by an enthusiast in Sussex, and many readers will remember that her sixteen-day journey to her new home near Chichester was reported a few months ago in the daily newspapers. She is now to be preserved, and I for one wish her owner much happiness in her possession—though not without a touch of envy on my part!

(To be continued)

A SMALL BENCH GRINDER

by D. Churm

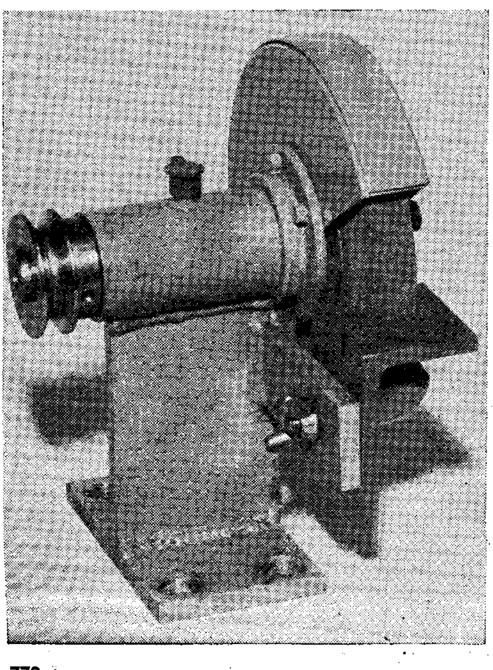
THIS grinder has been made out of bits and pieces which were to hand, the only part which was bought was the wheel itself, which is 4 in. dia. × ½ in. wide, and runs when in use at 6,000 r.p.m.—the maker's recommended speed for this wheel. The grinder is 4 in. high from base to centre of the spindle and the width of the body is 2½ in. The spindle, which runs in bronze bushes, is made of mild-steel ⅝ in. dia. Perhaps to some people this grinder may seem rather small, but in use it serves the purpose for which it was made; that is, of course, for sharpening small home workshop tools. The tool rest is a piece of angle-iron, and the arm which is welded to the body is 1 in. × ¼ in. mild-steel. As can be seen, it is adjustable for tool angles and wheel wear by loosening the wing-nut. The wheel guard is made in two pieces, one half fitting over the other half a good snug fit to prevent it vibrating off.

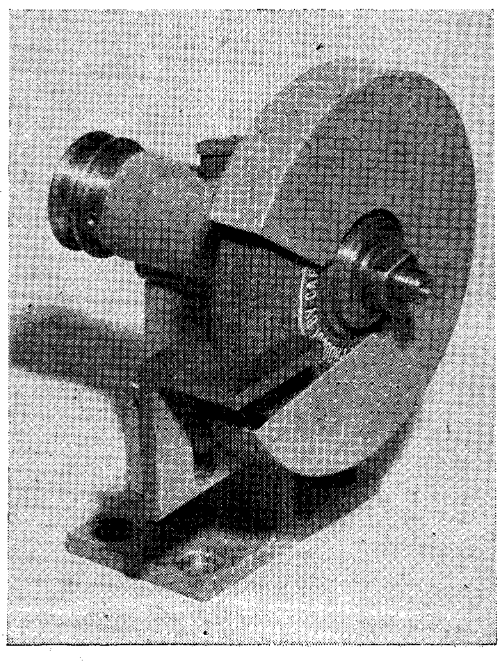
The guard is made of 18-s.w.g. sheet steel, two pieces 4½ in. dia. being cut out with snips and the pieces for the edge ¾ in. wide, and then gas welded. The parts for the grinder body were electric welded together at the local works.

Anyone wishing to make a grinder like this one can make it any size they wish, and I am sure they will find it well worth the trouble. No doubt the material at hand in the scrap box will determine the size.

The oil cup was one I found in the junk box, but these can be bought at a cycle shop.

The photographs were taken by my friend, Mr. Haycock.



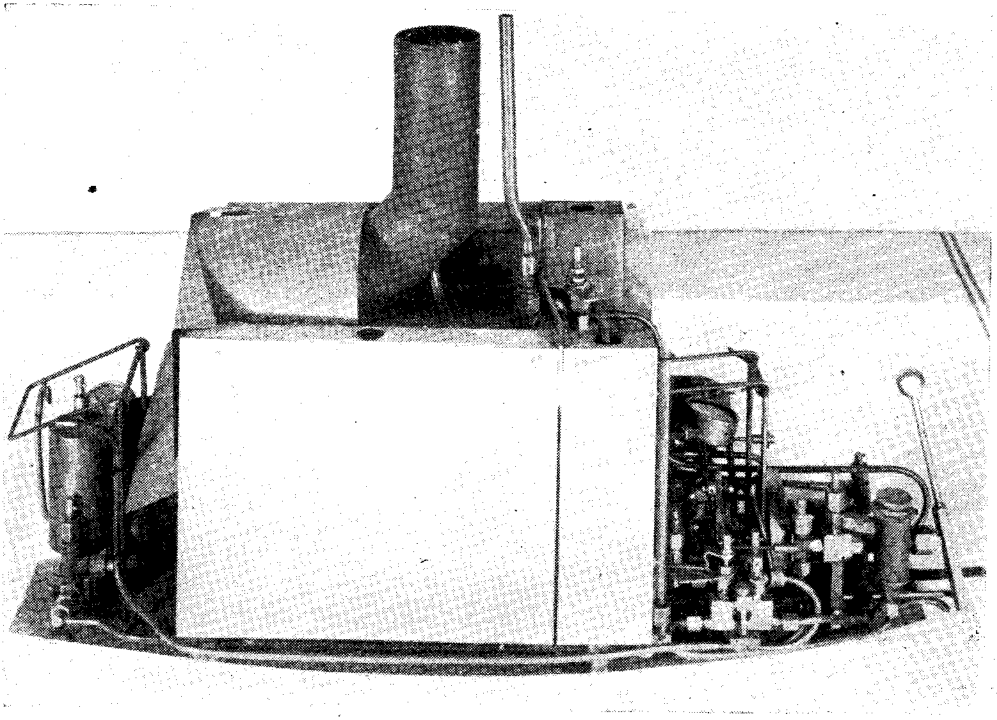


An Automatic Steam Plant

Incorporating feed regulation and an atomising burner

by J. F. Croll

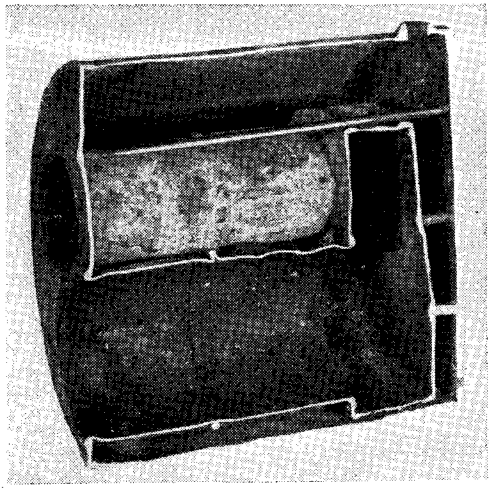
THE history of this burner is the story of my search for a source of heat for model ship boilers which could be kept going indefinitely and be self-regulating. Any drip tray or wick burner meets the first qualification but the heat available is insufficient for outputs exceeding 1/50 h.p. in the space usually available owing to the need for very large flues with natural draught. Blowlamps give the heat and supply their own forced draught, but for a duration exceeding half an hour the container becomes bulky and heavy. Some success was had with a blowlamp burner fed from an open unpressurised tank by mechanical pump on the engine. (See photographs Nos. 1 and 2.) The micrometer scales on the suction-valve spindles of fuel and feed pumps can be seen on the extreme left and right of photograph No. 2 and a similar scale on the steam stop-valve in front of the funnel. The engine below the pressure gauge is a three-cylinder raidal oscillator. In front of it is the flywheel and centrifugal clutch. The lubricating oil pumps ratchet wheels are on each side of the flywheel. The injector is at right-hand bottom corner. Paraffin and feed tanks flank the boiler. The most successful regulation was by micrometer control of the suction-valve lift, a pointer on the 7-B.A. spindle moving over a scale on the spindle gland graduated in quarter thousandths (0.00025). Even this was subject to gradual gain or loss and required adjusting at intervals rarely exceeding 20 min. Attempts to use a spring loaded bypass failed, as particles of solid matter were filtered out by the valve which could always open but never close unless the amount pumped was many times (100) the burner consumption and the valve kept well off its seat. The solid matter in filtered fuel came from wear



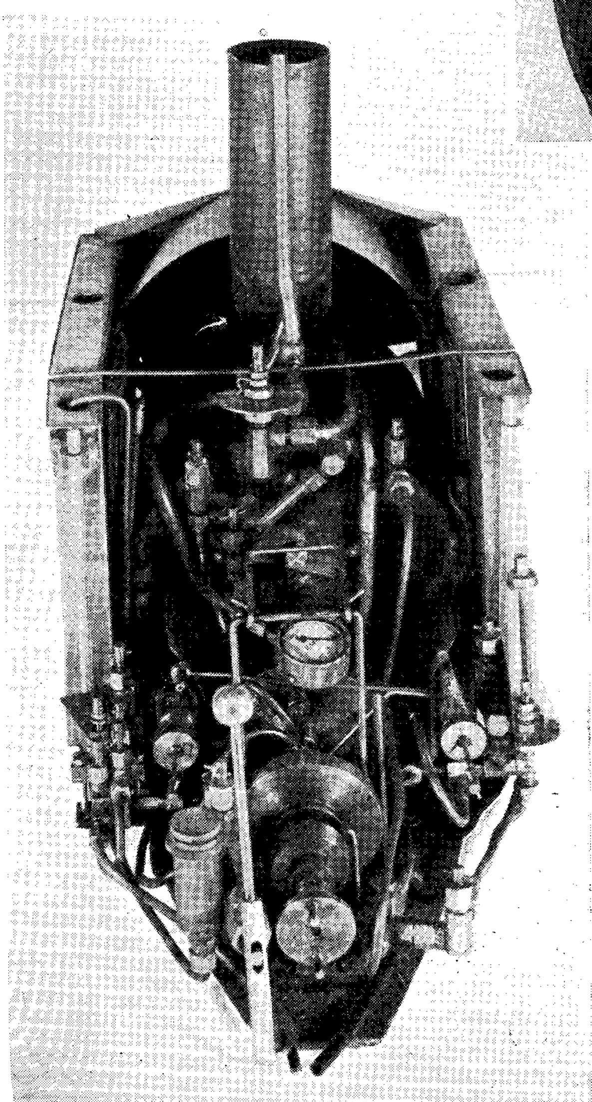
Photograph No. 1. The cylinder on left is the air reservoir on the paraffin feed-line to burner. At the extreme right is the fuel starting hand-pump and fuel filter. To start, the vaporiser required heating with another blowlamp

on the pump and carbon blown back from the burner on a shut down. Also, while this could control the burner output, steam consumption and feed input had to be exactly matched. It worked, but a pot boiler and blowlamp of 15 to 20 min. duration would have given less work.

The next stage was the making of a fully automatic power unit requiring only the replenishment of open tanks at intervals of 30 min. to two hours according to the power taken off. This was made up on a baseboard for exhibition purposes with a propeller in a glass fronted water tank and ran for four or five hours a day at the St. Albans Club's exhibition in January, 1950. The boiler was a Scotch marine type all welded steel 5 in. diameter × 5 in. long, 2 in. furnace, wet back combustion chamber and two $1\frac{1}{2}$ in. diameter tubes returning to smokebox. (Photograph No. 3.)



Photograph No. 3. Section through Scotch marine-type boiler



Photograph No. 2

This boiler, shown in photograph No. 3, was the first of a series of four. It was sectioned when the furnace collapsed on account of low water. Later types had reinforcing rings at 1 in. intervals on furnace and smoke-tubes. For the automatic plant the smoke-tubes were placed further apart and lower. With the steam dome above the combustion chamber, and the float resting on the combustion chamber when the boiler was empty. These boilers could produce enough steam for 1 h.p. with an engine using the full expansion of the steam. The later types were tested to 350 lb. per sq. in. and operated at 150. No sign of rusting is noticeable and the only failure from this source made a pin hole from the outside caused by saturated lagging. The water content was 2 lb., and a steam dome was fitted, as the output was rather high for the limited steam space, and without the dome priming took place if maximum output was used. The engine was a piston-valve double-acting $\frac{1}{2}$ in. bore and stroke with $\frac{1}{16}$-in. bore and $\frac{1}{4}$-in. stroke feed pump, 3/64-in. bore and stroke mechanical lubricator on a 60-tooth ratchet. Maximum brake horse-power about 1/30. Boiler pressure was 125 lb. per sq. in., but the throttle was never fully open, as then the pressure could not be maintained. More recently this engine has given a reading of 1/8 h.p. on a bigger boiler at 4,000 r.p.m., and running with only the feed pump load, has exceeded 15,000 r.p.m.

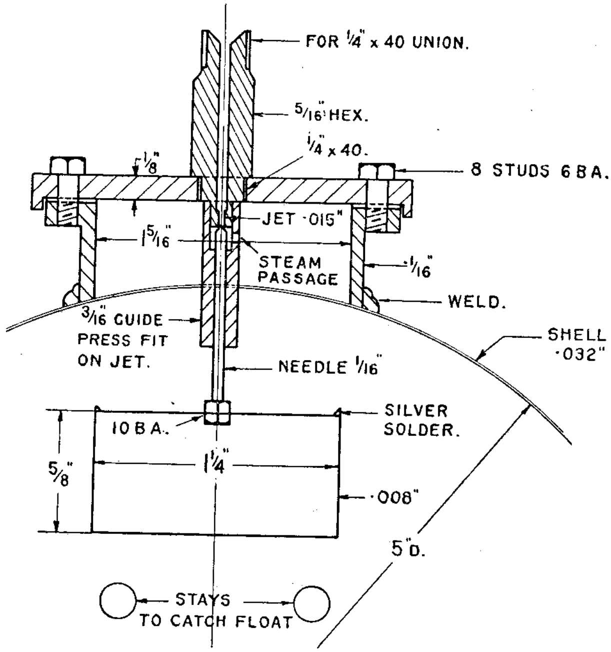


Fig. 1. Steam dome and float

The design of a burner controlled inversely by the rise and fall of the steam pressure and of float gear to regulate the admission of feed preceded by a few weeks the discussion of these matters in THE MODEL ENGINEER, where the problems were propounded but not solved.

The solution lies in the making of jets in sizes varying from 0.003 in. diameter upwards according to the output required. The general arrangement for feed is a pump capacity exceeding maximum demand of engine and auxiliaries, a bypass valve with steam cylinder to close it, an inverted bucket float in boiler with needle-valve to shut off steam closing feed bypass, a leak off jet to release pressure to bypass steam cylinder. The critical points are the area of the needle valve seating and the blow-off jet. The calculation is as follows :

Float of 0.008-in. shim brass and needle must be weighed, as while it must float it must also be heavy enough to pull the needle off its seat against the steam pressure. With float $1\frac{1}{4}$ in. diameter and $\frac{5}{8}$ in. deep and 1 in. of $\frac{1}{16}$-in. brass needle floating with $\frac{1}{2}$ in. of float submerged, the displacement is 0.615 cu. in. or 0.58 oz. of water (temperature variations can be neglected). Then the weight is equated against boiler pressure × valve area being 0.58 oz. = 125 lb. per sq. in. × area

$$\text{or area} = \frac{0.58\ oz.}{125 \times 16\ oz.} = \frac{0.58}{2000}$$
$$= 0.00029\ sq.\ in.$$
$$= \pi r^2$$

Then $\sqrt{\dfrac{0.00029}{3.14}} = V =$ Wo.000092 = 0.0095

and diameter = 0.019 in.

At this figure the float would hang up as the water receded, so I used a 0.015 in. seat and never had the float fail to drop. Note, for higher pressures the seat area must be smaller. The pressure leak off jet I used was 0.005 in., and a $\frac{1}{2}$-in. piston on a bypass valve with seat $\frac{1}{16}$ in. gave prompt and certain action. A small spring was used to assist the opening of the bypass valve, as the pump pressure would not open it fully against the gland packing friction and unnecessary load was left on the pump. In practice this device allowed a rise and fall in the water level of about $\frac{1}{8}$ in., showing a safety margin of 3, boiler vibration probably helping to shake the valve off its seat even before the full calculated weight became available. (Fig. 1.)

For demonstration purposes pumping at 200 per cent. of steam consumption, the control cut in and out every minute. When feeding, a cigarette would glow brightly in front of the blow-off jet indicating pressure on the control-line, and a stream from the bypass return would show boiler full. The bypass motor cylinder had an open end

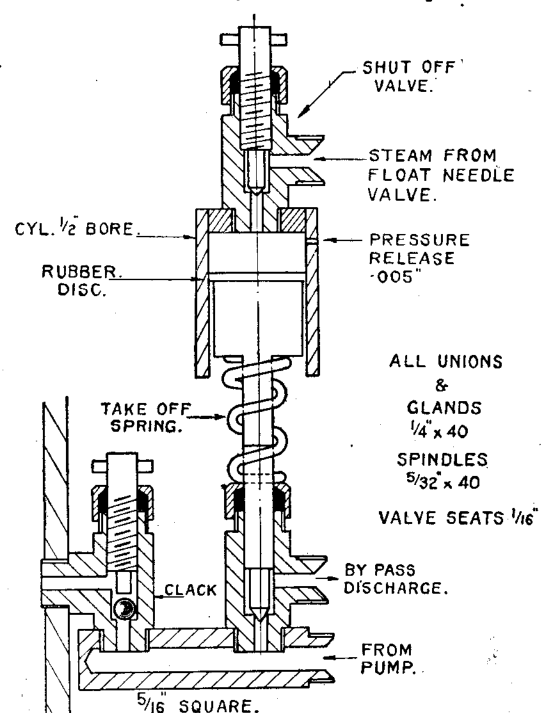


Fig. 2. Boiler clack and steam controlled by-pass valve. Plates and studs holding cylinder to square manifold not shown

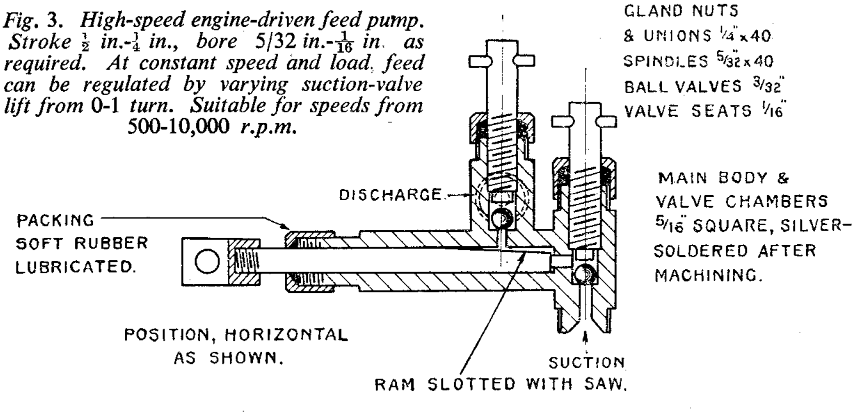


Fig. 3. High-speed engine-driven feed pump. Stroke ½ in.-¼ in., bore 5/32 in.-1/16 in. as required. At constant speed and load, feed can be regulated by varying suction-valve lift from 0-1 turn. Suitable for speeds from 500-10,000 *r.p.m.*

with a brass piston and a rubber disc. The piston was a loose fit and the disc a good fit (it was a punching from a car inner tube about 3/32 in. thick). As the cylinder and pipe below the blow-off jet was always full of condensate, the rubber never suffered from heat. I have used this form of hydraulic packing on thermostats working to 1,600 lb. per sq. in. where it had a life of two months at temperatures up to 212 deg. before the rubber pushed down the side of the piston and jammed it. These were used in the header tank of a car radiator to open the shutters against a spring. For normal running, the pump suction valve should be closed to allow only a small excess of feed and the pump will be bypassing for only a ½ min. in 10 min. and very steady running conditions obtained. (Figs. 2 and 3.)

The other automatic device, the burner, to be dependent on the boiler pressure had to be of the atomising type, as vaporising introduces too many variables and a vaporising burner has only one rate of burning at highest efficiency. Increasing pressure usually increases vapour temperature and the over expanded gas usually induces excess air giving a purple instead of a blue flame, and if overdone, the flame just blows away as when too volatile a fuel is used.

Spray burners in full size practice are usually of the solid injection type, as the 200 to 300 lb. pressure required for atomising can be obtained for less than 1 per cent. of boiler output. Steam atomising takes 5-7 per cent. of output and compressed air 10 per cent. But for models the limit is jet size. On a boiler evaporating 10,000 lb. per hour the jet size for solid injection is only 0.070 in. on two jets, one in each 36 in. furnace. For a 2½-in. furnace and an evaporation of 2 to 12 lb. per hour the jet at the same efficiency would be 1/500 of the area, say 0.003 in. diameter and the tangential passages to secure rotation and atomisation of similar size. They could be made, but imagine trying to clear the hard carbon which forms on such jets. It is a bad job on the big ones and while 4 to 8 hours' run is possible, hourly changes of jets for cleaning are not uncommon. Although the calculation gives a 0.003-in. jet, experience suggests to me that even smaller jets would be needed, and fuel filtration and high pressure pump packings are more problems.

The air-spray jet can be used, but it takes steady going on a car foot-pump, and by the time the boiler shows pressure I am glad to change over to steam. For a stationary plant a compressor can be used, but on model scale of the size under discussion the compressor would take all the energy of the plant.

Steam differs from compressed air; almost any pair of pipes with one blowing across the other will spray a low viscosity fuel with air, but steam is exacting in the detail of the jets, and their positioning, as in the case of the feed injector, of which there are many models but few working ones. In the case of the injector, say 50 per cent. of perfection is necessary, or the water just will not enter the boiler, but with the burner results can vary over a much wider range and the operator has the jets in the open where he can see what is happening and step by step attain perfection. As the combining type of jet has not the advantage of visibility and involves a similar labyrinth of passages to the solid injection types, the scent spray or "flit" gun type is the best to study and here a definition of the characteristics which we may call perfection can be set forth:

(*a*) Power output widely variable (say 1 to 20).
(*b*) Constant mixture strengths at all outputs.
(*c*) Free from popping out.
(*d*) Not fussy about type of fuel.
(*e*) Easily adjustable for the type of fuel, wear and furnace resistance (draught).
(*f*) Easily lit.
(*g*) Having its own starting equipment.

All this can be achieved in powers from thousandths of a horse power upwards to any limit.

(*To be continued*)

PRACTICAL LETTERS

Acknowledgment

DEAR SIR,—I notice that my name only is being associated with the 6 n.h.p. Ransomes show engine, and the Tangye gas engine, both in the official exhibition catalogue and THE MODEL ENGINEER, whereas the Ransomes engine is the joint work of the writer, F. H. Tapper and F. Moulson, and the Tangye engine the work of the writer and F. H. Tapper.

Yours faithfully,

Smethwick. A. J. KENT.

The Dean Bogie

DEAR SIR,—I had a very pleasant surprise when I read "Smoke Rings" and your kind remarks about my $\frac{3}{4}$-in. scale Dean bogie frame in the November 13th issue.

By the time of the next show I hope to have this complete except for painting, and the main frames reasonably well on, as I now have the full set of wheel castings. The patterns for these I had to make, as there are no patterns that I know of which are representative of the wrought-iron wheels used originally on this class of engine at the time. (My model represents one about 1896.)

I am also doing a pretty complete set of drawings and have endeavoured to keep everything as close to the original as possible, except for such things as the boiler internal and some of the fittings; also, I have modified the valve-gear to long-lap Stephenson. This is drawn at present with launch links and top suspension. I am, however, going to modify this again to launch type links and centre suspension to get a better backward valve event. I feel this is necessary in a model which usually spends nearly as much time going backwards as forwards.

I would add that without the very kind help of Mr. J. N. Maskelyne, who has placed all his information at my disposal, together with the Swindon general arrangement, I doubt if I could have been able to get the information I needed to get on with the construction of such a locomotive.

If there are any people amongst your readers who are *genuinely* interested in making a model of a Dean single, I will be only too pleased to give them any help I can.

Yours faithfully,

Maidenhead. D. G. WEBSTER.

Three-cylinder Double-piston Engine

DEAR SIR,—With reference to your remarks on pp. 631-632 of your issue of November 13th, readers may be interested to learn that one of the objects in view when designing this three-cylinder petrol engine in 1940 was to obtain, in effect, the maximum size of twin engines to drive twin screws, which would be accommodated in a 6 in. beam boat. The resulting design may be likened to two three-cylinder engines of 1 in. stroke in an overall width of less than 6 in.

Another object was to reduce the number of working parts to make. By combining the valve chambers of each pair of cylinders, six pistons work on only three inlet valves, three exhaust valves and six cams.

The only real "added complication" is three carburettors. This was done to facilitate easy starting, and to reduce the chances of stoppages when the boat and engine on which one has spent so much time, and money, was pitching and rolling violently and was far away or difficult to reach in open waters. The engine is designed throughout for long hours of continuous running at full power, and not for short bursts of maximum output from its cylinder capacity.

Yours faithfully,

Bishops Stortford. A.W.P.

Slotting Attachments

DEAR SIR,—I notice that "Duplex", in describing the slotting attachment in the issue of October 2nd, suggest that the automatic feed of the lathe should be allowed to operate when using the attachment.

May I be allowed to point out that this is fundamentally wrong practice.

The movement of the saddle resulting from rotation of the leadscrew is continuous, and it, therefore, follows that the work-piece would be in motion during the cutting stroke. The operation of this attachment is analogous to that of a shaper or planer, and in both these machines arrangements are made to arrest transport of the work-piece during the period of the cutting stroke.

If, as "Duplex" suggest, the automatic feed of a lathe is used, a definite side thrust will be thrown upon the slide carrying the toolpost, and wear will soon render the equipment slack. Also, it would be impossible to produce a cut surface truly vertical in both planes of the lathe.

I would, therefore, advise readers who construct and use this attachment to content themselves with hand feed, timing the advance of the work to coincide as nearly as possible with the idle upstroke of the tool.

For those readers who care to take the trouble, I suggest that they would do well to provide a spring-loaded tool box to relieve the tool on its idling stroke.

Thanks are due to "Duplex" for their original conception of the attachment, and to Mr. Westbury for his drawing, which, like all Westbury products, looks so essentially "right" and convincing.

Yours faithfully,

West Wickham. ALEX. B. STORRAR.

A Turning Hint

DEAR SIR,—Recently, whilst doing some turning between centres with the catchplate and pin working, I had the idea to slip a piece of snugly-fitting rubber tube over the catchplate pin to obviate the noise.

Even when the pin is tied to the driving dog with a leather lace, the rubber tube cuts out the annoying chatter.

Yours faithfully,

Falmouth. HAROLD V. EDDY.